# PROFESSIONAL LABOR AS A CONSTRAINT ON CORPORATE LOCATION: THE CASE OF R&D FACILITIES

By

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# PROFESSIONAL LABOR AS A CONSTRAINT ON CORPORATE LOCATION: THE CASE OF R&D FACILITIES

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This study examines the degree to which the locational preferences of professional and technical workers determine the location of R&D facilities. Corporate R&D program success depends on an ability to attract and retain highly qualified technical and professional workers. Although professional workers are a very mobile segment of the labor force, they are geographically limited due to their locational preferences for certain types of places. Locational choice and mobility is further complicated by the rise of dual career couples--couples with both partners engaged in continual professional employment.

The study utilizes two different methodologies. One method employes census data to examine the locational preferences and mobility patterns of professional and technical workers and dual career couples. The second method involves survey questionnaires. The questionnaires were designed to elicit information concerning job search and locational preferences of R&D professional employees and how R&D facilities evaluate places and choose locations.

The findings of this study indicate that R&D facilities are influenced in their locational decision by the locational preferences of professional and technical workers. The results suggest that firms in choosing their present location for their R&D facility have had to compromise their own locational needs in favor of their professional labor force. Quality of life and city size are significant locational considerations to both professional workers and firms that conduct R&D. Three urban attributes that appear to be crucial in attracting professionals and R&D facilities are a university, airport, and a professional labor force.

Despite a recent dispersing trend, the results of this study suggest that R&D facilities will remain geographically concentrated in large metropolitan locations and a few smaller centers. Significant to all R&D locations is a high quality of life and the presence of a university. These results demonstrate and reinforce the benefits of agglomeration

economies associated with large urban areas to the location of industry.

# CHAPTER 1
# THE GEOGRAPHY OF R&D, PROFESSIONAL LABOR AND LOCATION THEORY

## Introduction

Much discussion concerning economic growth and development over the past few years has focused on research and development (R&D) and high technology industries. It is generally accepted that the economic health of a nation is dependent upon and largely determined by the development of its technological potential (Buswell, 1983; Hall et al., 1987). Research over the past 30 years has conclusively established the critical role played by technological change in generating long-term economic growth (Landau and Rosenberg, 1986). At the regional level, however, it is much more difficult to anticipate the impact of technological change. The link between R&D and regional growth is very complex, evolves over time, and is not yet fully understood. Regional development is dependent on the activities and the location decisions of firms (Knapp and Graves, 1989). As a result, regional research and government policy has focused on high technology industries and their contribution to regional economic growth and development.

An increasing number of communities and regions are competing in their attempts to attract high tech activities, including R&D facilities. A select few areas have met with success--Silicon Valley in California, Route 128 around Boston, and Research Triangle in North Carolina--but overall relatively few regions have actually benefitted from R&D location decisions. Why have some places succeeded while many others have failed to become high tech complexes? In large part, this is due to the striking persistence in the geography of corporate R&D. Corporate R&D facilities are concentrated in a few areas and are likely to remain so, as the results of this study also indicate.

The importance of technical and professional workers to high tech firms sets them apart from other firms. Although this is not necessarily true in the routine manufacturing end of high tech, it is particularly evident in corporate research and development laboratories. The success of R&D programs depends on the ability of firms to attract and retain highly qualified technical and professional workers. R&D facilities are dominated in their location decision by the twofold need for communication with other units of the firm and for technical and professional workers. This segment of the labor force is highly mobile but also displays strong locational preferences for certain types of places. As a result of these preferences, scientists and engineers exert considerable influence on corporate R&D location decisions. Thus, in determining the location of R&D facilities, two sets of locational priorities are at work--the firm's organizational needs and its employees' locational preferences--simultaneously constraining and reinforcing each other.

The research thus far on the location of R&D has acknowledged the importance and dependence of R&D on these two factors--corporate constraints and professional and technical labor--but has failed to adequately link the two issues. This study will integrate these twin concerns by (1) comparing the locational decisions and preferences of both firms and their employees and (2) identifying locational attributes that are important in determining the location of R&D facilities and of professional workers. This research will contribute to our knowledge of the geographic patterns of professional labor and of the forces that generate these observed patterns. The results of this study will provide additional insight into the positive aspects of communities in the context of attracting R&D and thus enhancing the development of places.

## The Location of R&D

Regional development is largely determined by the strategies, location decisions, and mobility behavior of firms and households (Knapp and Graves, 1989). Although firms have many locations from which to choose, the geography of R&D has shown that R&D facilities are spatially concentrated to a greater degree than other types of corporate activity. In the

United States, R&D is strongly concentrated in metropolitan centers located in the traditional innovative core regions of the manufacturing belt and in a few Sunbelt locations (Malecki, 1980a; 1981c). Likewise, British R&D is highly concentrated in the country's Southeast (Howells, 1984). Several checklists of locational factors specific to R&D facilities have indicated that a few essential attributes are important (Ady, 1986; Browning, 1980; Lund, 1986; Rosenberg, 1985). These studies suggest that R&D facilities are dominated in their locational decision by (1) the ability to obtain and retain individuals with specific technical, scientific and engineering occupations and (2) communication within the firm (Ady, 1986; Browning, 1980; Herzog, Schlottmann and Johnson, 1986; Lund, 1986; Premus, 1982).

Different location factors influence the various firm functions (Browning, 1980). However, both firm headquarters and R&D facilities are strongly influenced by a similar set of locational factors: availability of executive/technical talent, air accessibility and highway accessibility (Browning, 1980). Firms with only one R&D facility nearly always have it located at or near the corporate headquarters; firms with more than one R&D lab are also likely to have a facility near the firm's headquarters (Malecki, 1980b). Close proximity to the firm's administrative base facilitates interorganizational interactions and communications, especially between marketing and R&D functions (Hall and Markusen, 1985). In the U.S., 88%

of firms have their R&D facilities and headquarter functions located in the same metropolitan area (Malecki, 1980a). The fact that R&D is attracted to both the locations of skilled labor and to the corporate headquarters tends to reinforce the agglomeration effect and attraction of large cities.

Despite this pattern of concentration in relatively few places, there is also a trend toward deconcentration primarily because not all research laboratories of large firms are located within close proximity of their headquarters (Malecki, 1981a). Thus, although internal corporate factors are significant in determining the location of R&D facilities, other factors such as the R&D labor force play an important role. In the U.S., new locations of R&D have emerged in the Southeast, West and South. In the Northeast, R&D activities have decreased in the larger metropolitan areas in favor of smaller city locations (Malecki, 1980a). Buswell (1983) observed that R&D activities prefer locations which maximize the "psychic income" of R&D workers, such as attractive suburban or exurban environments in relatively close proximity to metropolitan areas. This fairly recent decentralization trend occurring in the U.S., Britain and France is regarded as a result of firms following the locational preferences of their workers to sunbelt areas (Buswell, 1983). However, R&D is still very much an urban-based activity despite the presence of this decentralization trend (Malecki, 1979b). R&D relies on urban-based activities and services such as libraries, universities, patent offices, and other research laboratories and, as a result, it is access to these activities along with labor requirements which impose locational constraints on R&D.

The specific purpose of the study is to examine how and to what degree the locational priorities of professional and technical workers influence the location of R&D facilities. These locational priorities will be influenced by the attributes of urban areas as residential and employment locations. The results most likely to emerge concern the advantages large urban areas provide to both firms and employees, especially dual career couples.

## Professional Labor

The importance of professional and technical workers to high technology firms and R&D is clearly illustrated by the fact that high tech industries are frequently defined by an above-average percentage of their labor force in engineering, scientific, professional and technical occupations (Weiss, 1985; Markusen et al., 1985). It must be remembered that R&D workers are only a subset of skilled professional high tech workers, and that professional and technical workers are not found only in high technology industries. However, professional and technical workers are differentiated from other workers in that they are highly educated, autonomous and career oriented (Walker and Storper, 1983). Because professional and technical workers are knowledge-based, they can--and do--have a great deal of choice over where they wish to live and work (Massey, 1984). The availability of labor skills varies between regions and cities (Scoville, 1973; Walker and Storper, 1981). Like R&D facilities, R&D workers themselves display a highly concentrated geographic distribution (Malecki, 1981b; Massey, 1984). Empirical results indicate that larger cities contain relatively more scientific employees than smaller cities, especially scientists involved in R&D (Malecki, 1981b).

New technological developments and innovations have caused structural changes in employment and the labor force (Massey, 1984). The introduction of new technologies has increased the demand and need for highly skilled professional workers in all industries (Weiss, 1985; Massey, 1979). As a result, the significance of professional labor has increased as a location factor through the development of new technologies (Weiss, 1985).

Recent social trends have been transforming the composition of the professional and technical labor force. Women have been entering the labor force and professional occupations in increasing numbers. One outcome is a new phenomenon--the dual career couple in which both partners are engaged in continual professional employment. Retention of existing professional talent as well as attracting new talent is one of the most important considerations for firms, and the dual career couple has increased the complexity and difficulty of these tasks (Von Glinow, 1988). Dual career couples decrease household mobility and, as a result, impact on corporate location.

## Aim of Study

The purpose of this study is fourfold:

1. to understand the influence of the labor market for professional and technical workers on the location of corporate R&D facilities;
2. to identify what kinds of places are preferred locations for professional and technical workers;
3. to identify which kinds of places are preferred locations for R&D facilities; and
4. to determine to what extent firms take into account the locational preferences of their professional and technical workers when determining their R&D facility location.

This research will examine and compare the locational decisions and preferences of both R&D facilities and their professional employees and determine to what degree the locational priorities of professional and technical workers influence the location of R&D facilities. It is still unknown if people follow jobs or jobs follow people when determining location. However, given the increased importance of labor in determining firm location relative to other location-specific factors, it is plausible that jobs may indeed follow people (Keeble and Kelley, 1986; Knapp and Graves, 1989). The study will also identify the favorable economic, residential, cultural and environmental attributes of these places as identified by the firms and professional workers. The competition between regions, cities and states for high technology companies and jobs is growing. It is becoming increasingly important for communities to be aware of how location decisions are determined before they develop strategies to lure high tech companies.

## Significance of Study

One may ask: why another study on R&D? First, R&D merits investigation because it is generally regarded as having a major positive effect on economic growth and employment (Mansfield, 1968; Landau and Rosenberg, 1986). R&D has been credited with creating employment (Markusen, Hall and Glasmeier, 1986), keeping mature industries competitive, and creating whole new industries (Landau and Rosenberg, 1986). For an individual company, R&D contributes to the firm's competitiveness and productivity, generates growth and profits, and ensures corporate survival.

A regions's economic well-being, in turn, is directly tied to the health of its industrial structure (Ewers and Wettmann, 1980; Oakey, Thwaites and Nash, 1980). Thus, it is largely through location that R&D affects regional economic development. The presence of R&D is directly related technological innovation, the development of new products and processes. Not all of these benefits will remain in the area where R&D is conducted. The significance of R&D location to regions is its ability to generate new economic activities either through new spinoff enterprises or product innovations. The production of new products often takes place at or near the R&D site (Thwaites, 1982; 1983). Process innovations, which contribute to the overall competitiveness and productivity of the firm, frequently have their greatest impacts at production sites considerably distant from the R&D site. Innovative and nonroutine activities, such as R&D, are perceived to be more immune to cyclical and structural changes in the economy and are less likely to suffer closure or shift to lower cost areas (Jacobs, 1984).

## Industrial Location Theory

Economists and economic geographers have been working for over a century attempting to explain why economic activities locate where they do. During that time different theories and approaches have been developed. Traditional industrial location theory is based on neo-classical economics which focuses on cost minimization and/or revenue maximization. Locations are chosen based on the lowest cost given the availability of raw materials, labor, and markets as well as transportation costs. One of the major weaknesses of this approach is that labor is treated as just another homogenous input in the production process. The importance of labor as a location factor is underemphasized and its distinctiveness over space ignored (Walker and Storper, 1983). Another weakness of this approach is that it is static, and examines relationships at a single point in time or, at best, comparisons across time periods (Hall et al., 1987).

However, since the development of traditional location theory many changes have occurred. Firms have transformed from single plant, single location entities to multiplant organizations occupying many locations. Diversification and new forms of automation increased the separability of the production process (Chandler, 1962; Storper and Walker, 1983). This has allowed different units of the same firm to seek out their best location without being tied to other work units with different locational needs. It was during the 1920s that firms first began transferring and applying science and scientific know-how into the production process and the development of new products (Chandler, 1962). This strategy resulted in the systematic organization of research and development as a specific, separate activity (Mandel, 1975). Furthermore, markets, production, and competition have become worldwide in focus (globalization of industry), while the locational differences in the availability, cost, and quality of non-labor commodities have diminished (Storper and Walker, 1984). The location question has become increasingly complex, as the number of suitable sites for industry has increased. As a result, the old traditional models have been incapable of coping with these changes (Massey, 1984).

A new approach was developed during the 1970s and 1980s out of dissatisfaction with the traditional approaches to industrial geography. This new Marxist political economy approach aims to explore the geography of industry and jobs through an interpretation of the spatial organization of the social relations of capitalist production. According to the Marxist approach to industrial location, labor is the key to determining corporate location (Storper and Walker, 1984). This view of industrial location theory acknowledges labor's high degree of spatial differentiation and thus places labor in the forefront. Since labor demand and supply are differentiated according to function within firms and across industries, and over space, the distribution of industry represents the spatial division of labor (Clark, 1981; Massey; 1984; Walker and Storper, 1983). Rountine, standardized production requiring unskilled labor can locate almost anywhere because unskilled labor can be found virtually everywhere (Clark, 1981; Schoenberger, 1987). Low-skilled, labor intensive production and assembly operations have decentralized to peripheral areas and third world countries in order to reduce labor costs and increase labor control (Clark, 1981). Higher skill functions such as complex manufacturing, headquarters, R&D and marketing operations reside in core regions of advanced countries because of their dependence on skilled labor (Malecki, 1986). Thus, particular activities of the firm are matched to the geographic location of labor. One of the benefits of this approach is that it views industries as part of a dynamic system, allowing researchers to study the changes of industrial location over time (Walker and Storper, 1981).

Research to date from this approach has ignored the location of R&D and other higher order functions because these functions fail to fit into the class struggle explanatory field in which capital wrests control from labor (Sayer, 1985). Rather, research has focused almost solely on production and the movement of manufacturing. The geographical shift of branch plants to lower cost labor sites in rural areas or in developing countries, common in high tech as well as low tech industries, is cited as proof of the capital/labor struggle. While its focus on labor redresses some shortcomings of traditional location theory, the Marxist approach falls short in dealing with several realities of contemporary capitalism. This approach fails, for example, to come to terms with the fact that most foreign direct investment is located within the most advanced regions and countries. It also exaggerates the significance of labor intensive production and cheap labor locations, and underestimates capital intensive and highly skilled activity and the consequent need for market locations (Sayer, 1985). Most Marxist research on new technology has focused on technology causing deskilling, weakening labor's control over production, thus increasing capital's control over labor. But new technology can also strengthen labor's control over production and thus labor's power relative to capital. While acknowledging that labor is differentiated according to skill, control in the work place, and over space, Marxists have ignored the power skilled labor has over capital and thus its role in determining the location of headquarter and R&D facilities. Thus, this theory is useful for explaining job losses and regional decline but is less helpful for understanding firm formation, job creation or regional development (Hall et al., 1987).

Neither of these bodies of theory as yet fully explains the location of high technology industries and research and development. In agreement with Markusen et al. (1986), it is necessary to borrow pieces from the different theories in order to build an eclectic explanation of R&D location. The concept of agglomeration economies from traditional location theory is particularly useful to help explain the concentration of R&D. Borrowed from the newer Marxist approach are both an emphasis on labor as a location factor and the knowledge that professional and technical labor are unique in terms of control over their work and thus in their relationship with capital and their spatial or locational preferences. As a result, useful elements of both theoretical approaches will be combined in order to explain the geographical concentration of R&D and the role professional and technical labor have in determining this location pattern.

## Plan of Investigation

Despite knowledge about the aggregate geographic patterns gained from previous studies, it is still largely unknown why R&D is so geographically concentrated. This study attempts to support the development of a location theory for corporate R&D by investigating the interrelationship between the location of R&D facilities and their professional labor force. Any model of R&D location must deal with the joint decisions of both the firm and the labor force (Shapero, 1985; Malecki, 1987). Finally, the findings from this study should provide additional insights on the issues of corporate location and on the prospects for regional development based on high technology.

Chapter 2 presents a review of the literature concerning the locational needs and priorities of both R&D facilities and their professional labor force. Recent social changes, such as the increasing labor force participation rate of women, have transformed the composition of technical and professional labor and affected its mobility and spatial distribution. The methodology and results of a national-scale analysis concerning professional labor, dual career couples and geographic mobility are reviewed in Chapter 3. Chapter 4 presents an analysis of the findings from a nationwide survey of R&D facilities and professional labor. Chapter 5 brings together the results presented in the two preceding chapters and examines the relationship between firms and local labor markets. This chapter also focuses on the consequences of the research findings regarding corporate location and the economic development potential of places. Policy implications with regard to economic development will also be discussed. Finally, Chapter 6 reviews the conclusions and assesses the contributions of this research to location theory.

# CHAPTER 2
# INDUSTRIAL LOCATION AND LABOR MARKETS: A REVIEW OF THE LITERATURE

## Introduction

This chapter reviews the literature relating to industrial location and labor markets. In studying the location of R&D facilities and professional and technical labor, many other issues must be considered, including agglomeration economies, migration, and quality of life. The chapter is divided into two main sections. The first half of the chapter reviews location theory, the role of R&D within the firm, the location of R&D facilities, and the attraction of large urban agglomerations. The second half of the chapter focuses on labor markets and mobility, professional and technical labor, quality of life factors, and dual career couples. The chapter concludes with a short summary and brief outline of the empirical portion of the study which follows in subsequent chapters.

## Location Theory

According to the Marxist framework, the geographical patterns of firms and labor are the outcome of socioeconomic processes operating over space. Thus, in order to understand the patterns it is necessary to examine the social and economic structures and processes which produce these patterns (Massey, 1984). Capital and labor are captives of each other and of the production process they must carry out. The relationship between capital and labor can be characterized as interdependent; firms depend on labor for the generation of surplus value and labor depends on capital for its livelihood. However, conflict exists between capital and labor over control of the production process and conditions of employment (Clark, 1981). Location is only one of several bargaining strategies available to capital in order to maximize profits. Capital (firms) constantly rearrange its (their) activities over space in order to maximize their control over labor and to reinforce its (their) authority (Clark, 1981). In this way, location is an essential means of shaping and reshaping the employment relation.

Mobility to a firm or capitalist is not a luxury; rather it is a necessity for survival. To understand business location, the location decision must be examined in its corporate context (Stafford, 1980). The product life cycle theory developed by Vernon (1966) can be used to explain industrial location shifts and regional growth. According to the life cycle model, products, firms, and industries disperse down through the urban hierarchy as they evolve through three distinct stages in their life cycle (Barkley, 1988). Each stage is associated with different growth rates, profitability, labor force needs, and locational requirements. The first phase, commonly referred to as the innovation stage, necessitates input from R&D as new products and processes are developed and intially produced in small quantities. Profits tend to be higher than normal, because of a lack of competition. Typically this phase of production takes place in large central metropolitan areas because of a reliance on skilled scientists and technicians, and specialized business services. During the second or growth stage, mass production occurs, the need for skilled labor is reduced, and competition enters causing normal profits to be attained. In the third stage routine standardized production and assembly operations can be shifted to low wage branch plants in peripheral regions, including Third World countries. Semi-skilled or unskilled labor can be used during this final phase. It is argued that production must be shifted from high cost central regions to low cost peripheral areas because competition has increased and profit margins are low (Markusen, 1985; Barkley, 1988). Since labor demand and supply are differentiated across industries and over space, the geographic distribution of industry is literally the spatial division of labor (Walker and Storper, 1983).

Erickson and Leinback (1979) provide empirical evidence in support of the product life cycle theory. They found that when production becomes standardized and routine, corporations establish branch plants in nonmetropolitan sites in order to reduce labor competition and costs. Clark (1981) proposes that the decentralization of manufacturing to nonmetropolitan areas can be interpreted as a means by which corporations improve their control over labor. A spatial division of labor is created because firms are able to separate functions spatially according to their labor needs at different stages of the product cycle (Clark, 1981; Markusen, 1985). Consequently, branch plants producing standardized products requiring low-skill or unskilled labor favor small cities with depressed local labor markets. On the other hand, higher order functions which require a highly skilled labor force, such as marketing, purchasing, and R&D, remain with the corporate headquarters in metropolitan areas (Clark, 1981; Erickson and Leinback, 1979).

High technology manufacturing has followed other industrial sectors in this decentralizing trend from metropolitan areas to nonmetropolitan areas (Barkley, 1988; Saxenian, 1984). Scott's (1987) observations on the semiconductor industry indicate that low-skilled jobs have shifted offshore and suggest this trend could lead to other more complex activities relocating abroad. Barkley's (1988) findings show that those high tech manufacturers who have decentralized to rural nonmetropolitan areas are characterized by slow growth and low labor skill requirements, thereby capitalizing on low land and labor costs. Conversely, more innovative high tech manufacturers increased their concentration in metropolitan areas, choosing to remain close to the source of skilled labor and specialized inputs on which they depend. Saxenian (1984) relates the situation of semiconductor and electronics firms in Silicon Valley which dispersed their manufacturing operations to distant locations during the 1970s. Despite the movement of manufacturing operations, however, firms remain headquartered in Silicon Valley along with research, design, and development activities.

Based on the product life cycle theory and empirical evidence, it appears that R&D will remain concentrated in metropolitan areas. Headquarter, research and development, sales, and administrative functions remain located in urban areas because of their dependency on skilled labor and specialized goods and services. However, the organization of R&D within the firm must also be examined.

## The Organization of R&D within Firms

Research and development involves the systematic and purposeful organization of scientific research with the aim of accelerating technological innovation (Mandel, 1975). It produces either new products or new productive processes. Research and development is only one corporate activity, albeit an important one, within the firm and it can be argued that R&D is the only true high technology activity (Malecki, 1984). The firm's corporate strategy determines the products, technologies, and the locations in which the firm will operate. The nature of competition within an industry also exerts an influence on production and its spatial location (Schoenberger, 1986). Corporate strategies determine whether R&D will be done at all and how much effort will be devoted to it (Malecki, 1980b). The importance placed on R&D activities varies among firms and industries and depends on the technological and competitive environment in which the firm operates. For those firms facing rapidly changing and uncertain technological environments and competition, R&D will be highly placed in the overall corporate strategy. Corporate strategy in turn determines the organizational structure of a firm. A firm's corporate structure can be either centralized or decentralized (Burns and Stalker, 1961). A corporate strategy focusing on long-term basic research tends to produce a centralized corporate structure. A centralized structure for R&D places all R&D activities at one (or a few) central facilities, typically in close proximity to the corporate headquarters. R&D activities which are oriented toward applied research or product development tend to produce a decentralized structure. While longer-range R&D is still centralized in one or a few facilities, other R&D activities are conducted within operating divisions. As a result, R&D activities are conducted at several locations in a decentralized organization.

Both organizational structures have advantages. The advantages of centralization include (1) economies of scale on capital investment in facilities and equipment; (2) improved internal communication between research groups due to close proximity; and (3) a large number of people and resources are available for major projects (Malecki, 1980b; Howells, 1984). Decentralized facilities tend to be better integrated with marketing and other corporate operations, and may avoid the problems generally associated with transferring a project from the lab to production (Malecki, 1980b; Howells, 1984).

## Location of R&D Facilities

The location of high technology industries exhibits similarities to traditional patterns of industrial location as well as significant differences. High technology firms have been termed "footloose" but they are not independent of geographical factors. Rather they are footloose in terms of traditional locational factors such as transportation costs but they continue to rely heavily on other spatial factors--access to information and labor (Malecki, 1987).

R&D by its nature is information based. Thus, access to scientific and technical information is crucial to firm survival (Rothwell, 1982). Firms require day-to-day information concerning markets, suppliers, and competitors particularly because of the fast pace of technological change.

The need for easy access to information and for a large skilled labor force compels firms to cluster together, reinforcing the agglomeration effect of large urban areas. Large urban areas maximize the opportunities for acquiring information while at the same time minimize the cost of obtaining it. Large cities provide easier access to information, allowing the free exchange of ideas and permitting face-to-face contact between individuals. Given these twin concerns, for labor and communication, R&D is likely to locate primarily in large urban regions (Malecki, 1987).

Large urban agglomerations are attractive locations for R&D facilities for several reasons. Most importantly, large cities can provide an adequate supply of professional labor. Firms recognize that urban areas facilitate job-hopping which will cause them to lose some valued employees, but it also increases the likelihood of finding workers who are leaving other firms, bringing with them new knowledge and skills that would otherwise be difficult to obtain (Ettlie, 1980; Kierulff, 1979). Large urban areas also provide a high level of urban amenities which are attractive to professional workers. The built environment and cultural amenities are more important than the physical environment of the area. Such things as variety and quality of shopping, restaurants, recreation, and cultural opportunities reinforce the advantages of urban size for, in general, larger urban regions rank highest in terms of urban amenities (Boyer and Savageau, 1985).

Furthermore, corporations are attracted to large urban regions due to other agglomeration advantages such as proximity to suppliers, services, information (Scott, 1983; Andersson, 1985), and urban infrastructure including airports and universities (Oakey, 1985; Malecki, 1987; Dorfman, 1983). Air transportation appears to play an important role in high tech business generally (Markusen, Hall and Glasmeier, 1986). Air transportation is important in the movement of management and R&D staff, who rely on face-to-face contact for the exchange of information which is so crucial to high tech firms (Oakey, 1985). Universities, particularly those which are active in research and have excellent graduate programs, attract R&D facilities of large firms. Universities not only provide another source of R&D workers and allow present employees to update their skills, but they also often serve as a source of information as well. But not all universities are considered equal. The location pattern of R&D clearly shows that areas with several very good local universities with graduate programs are most attractive to high tech firms and their R&D operations (Malecki, 1980a). Thus, large urban agglomerations offer a number of locational advantages to R&D organizations.

## Large Urban Agglomerations

Both positive and negative attributes are associated with large metropolitan areas as locations for firms and for labor (Thompson, 1974; Hoover, 1975; Isard, 1975; Hoch, 1976; Puryear, 1977; Dahmann, 1983). Explanations as to why large urban areas have grown and continue to attract firms and workers focus on the concepts of economies of scale and agglomeration economies. Economies of scale relate to production: as quantity or output increases the cost of each unit produced decreases. Large urban areas provide businesses with specialized services and a large market which increases productivity through economies of scale. Agglomeration economies are traditionally defined as consisting of localized and urbanized economies. Localization economies are the advantages to a firm from the spatial concentration of firms of that industry in a particular area. Urbanization economies are those economies which accrue to all firms in all industries at a single location. Urbanization economies reflect external economies that work between firms of different industries in a city while localization economies are restricted to externalities between firms within an industry (Nakamura, 1985). Urban size and agglomeration economies have remained over time a powerful locational force (Hoover, 1975).

Linkage access incorporates advantages of agglomeration especially for large cities (Hoare, 1985). Industrial linkages can be classified into two types: (1) physical flows of inputs and outputs between plants and (2) interpersonal contacts or information flows for the purposes of transacting business (Scott, 1983). Large industrial agglomerations enhance the choice of linkages available to a firm within a given distance, making it more likely that the firm will find suppliers able to meet its needs or the type of market it is seeking. The degree of agglomeration will depend upon the characteristics of the firm's linkages (Scott, 1986). Agglomeration economies are strongest when transaction costs are high, occurring typically where linkages are intense, specialized, and varied, requiring frequent face-to-face contact among firms (Scott and Angel, 1987). Clustering together in location is a means by which corporations can control risk and minimize uncertainty in their linkages. Oakey (1985) states that high technology firms locate in close proximity to one another because subtle advantages to innovations are gained from local information exchange through linkages with customers and suppliers. Agglomeration benefits obtained through linkages are considered the most important factor behind the persistent concentration of firms in Silicon Valley (Oakey, 1984; Scott and Angel, 1987).

There are two major types of benefits associated with urban size: greater productivity and greater variety or diversification of economic activity (Puryear, 1977; Mera, 1973). Urbanization economies and city size are especially important to a facility such as research and development or firm headquarters that are highly dependent upon creative management and skilled labor (Isard, 1975). Benefits to firms associated with increasing urban scale include (1) a large skilled labor market, (2) access to capital and information, both of which contribute to increasing the innovation potential of the area, (3) presence of infrastructure (such as universities, airports, laboratories), and (4) the presence of specialized business services, suppliers, and subcontractors. Benefits to labor include (1) greater choice of employers in a specific occupation, (2) greater consumer choice in terms of goods and services available, (3) higher wages and income, and (4) a superior cultural environment and greater entertainment opportunities. Increased costs are also associated with large metropolitan areas, such as increased labor and general operating costs (including land and taxes), increased cost of living (especially housing), increased congestion, pollution, noise, and crime rates, all of which contribute to decreasing environmental quality (Hoch, 1976; Hoch, 1977; Dahmann, 1983). Evidence suggests that there may also be diseconomies associated with city size and scientific activity (R&D) (Malecki, 1981b).

Large urban scale is critical for firms attempting to attract and retain key talent (Thompson, 1975). The substantial and real advantages that large cities offer labor are steady work, good jobs, occupational choice, occupational ladders to better jobs, and a better balance of bargaining power between employer and employees (Thompson, 1974). Greater occupational choice increases the probability that one can find a job that is compatible with one's skills and interests. Residing in a large metropolitan area makes it possible to change jobs without having to change residences and increases the probability that such job changes will occur. Being able to change jobs without migrating is especially important when different members of the same household are employed. Only large cities are likely to provide the wide range of occupational choice that makes it possible, even probable, that both an educated husband and wife will be able to find suitable employment (Thompson, 1974). Thus, large urban areas appear to be particularly attractive locations for dual career couples.

## Economic Implications of Labor and Migration

Labor force skills and availability are not ubiquitous, but rather vary over time and space. Researchers have been interested in the geographic movement of the labor force for a long time (Gallaway et al., 1967; Sjaastad; 1962). Such movement is viewed as a part of the general movement of productive factors, which theoretically function to adjust temporary imbalances within the economic structure (Smith, 1982). From an economic perspective, migration reflects how people respond to changing economic opportunities. People leave the areas in which they are living because they perceive better opportunities for themselves and their families elsewhere. The factors that contribute to migration are many and complex. Migration is a function of regional "push" factors--the lack of employment opportunities or lower wage rates--in the present area and the "pull" of employment opportunities, higher wage rates, and other attractive attributes of another area.

Mobility patterns may reflect variations in the regional supply or demand for professional and technical workers. They may also signal variations in the ability of interregional labor markets to satisfy local needs. Many people leave a region because they find higher real wages, greater job opportunities, or preferable life styles in other regions (Gentile and Stave, 1988). Migration is selective of younger, better educated and more highly productive workers (Lansing and Mueller, 1967; Greenwood, 1981; Gentile and Stave, 1988). Other factors that affect mobility include sex, marriage and family life cycle, occupation, race and ethnic origin, and regional location (Ladinsky, 1967; De Jong and Gardner, 1981). Men are more mobile than women; nonmarried people are more mobile than married couples, and couples with school aged children are less mobile than couples with pre-school aged children (Long, 1972). White collar employees are more mobile than blue collar workers and overall professionals are more mobile than all other occupations and are more likely to move over longer distances (Tarver, 1964; Stub, 1962). Professionals who reside in the West and South of the country are the most mobile, while those in the Northeast are the least mobile (Ladinsky, 1967).

Both economic and noneconomic factors play a role in determining an individual's propensity to migrate. Such factors as knowledge, opportunity, goals, desires, characteristics of places, and social and family structure need to be considered (Lewis, 1982). Noneconomic motives have become increasingly important in influencing migration especially among higher status persons such as professionals (Long and Hansen, 1979).

Nonetheless, economic and employment factors have been identified as major determinants of regional migration. Several studies have concluded that approximately 50% of all moves in the U.S. were to either take a job or to look for employment (Morgan, 1977; Long and Hansen, 1979). Long distance moves tend to be job related whereas shorter moves tend to be due to housing or family related issues (Lansing and Mueller, 1967).

Because employment opportunities are responsible for a large proportion of all moves, it can be argued that the migration process is highly structured by organizations such as businesses, industries, and governments. Organizations and institutions determine the supply, allocation, and location of employment opportunities (McKay and Whitelaw, 1977). The interaction between individuals within the labor force and organizations establishes the framework in which households make their decision to migrate (Lewis, 1982). The spatial configurations and policies of organizations will influence migration patterns since they determine the migration potential (employment opportunities) and the destinations for individual migrants (McKay and Whitelaw, 1977).

The subject of mobility contains considerable implications for both corporations and labor. Migration is an important factor in career advancement, and geographic mobility is positively related to income and occupational status (Markham et al., 1983). Many professional and managerial careers require a certain amount of geographic mobility either from one company location to another or from one job to another (Northrup and Malin, 1985). As a matter of policy, many corporations shift those employees showing management potential around the country, or around the world, in order to allow them to gain experience and expertise in various facets of the company. A growing number of migrants are moved by their employers for career opportunities (Lewis, 1982). The expectation that technical and managerial level personnel have the ability or willingness to migrate is usually an implicit, and sometimes an explicit, part of personnel policy (Tallon, 1979). Willingness to move is often seen by managers as a sign of commitment or motivation. As a result, promotion up the career ladder is often accompanied by geographic movement as well (Renshaw, 1976; Wolfbein, 1971). The refusal of an employee to relocate means the company must dip deeper into the labor pool and send less qualified people to the new assignment or location. Some firms still consider a refusal to transfer or relocate as an act of disloyalty or as a lack of motivation which can result in ruining a promising career. In this way, career development and advancement are clearly linked to geographic mobility.

## Professional and Technical Workers

Little work has been done on the mobility and locational preferences of professional and technical workers even though they are the most mobile segments of the labor force (Greenwood, 1975; Kaufman, 1982; Ladinsky, 1967; Gentile and Stave, 1988). The labor market for professional and technical workers, such as managers, scientists and engineers, is a national, even an international one. According to Shapero (1985), the movements of professional workers to particular geographic locations are strongly correlated with the general migratory pathways. Using the personnel records of 35,000 American scientists and engineers, he found that geographic movements between jobs correlated with general population migration patterns, from north to south and from east to west (Shapero, Howell and Tombaugh, 1965).

Although professionals have the highest rates of migration of any occupational group, relocation does not appear to be attractive to many professionals (Kaufman, 1982). A professional's willingness to relocate is affected by situational as well as personal factors such as employment opportunities, age, education, and family life cycle. Relocation is less likely to occur among those who are more flexible in the type of work they are willing to accept. According to Kaufman (1982), some unemployed professionals would rather remain without work or become underemployed than relocate. However, for jobless professionals who do relocate, evidence indicates that they receive benefits of higher salaries and greater job security than those professionals who remain.

The decision to relocate is a very complex process and the prospective job is only one factor in the decision (Hall and Hall, 1979). Other factors come into play, such as geographic location and quality of life. Although professionals travel farther to look for work than those in other occupations, they are much more likely than other workers to reject a job because of its location. In fact, location is the most important factor in the rejection of job offers by job-hunting professionals (U.S. Department of Labor, 1975). Mobility has exposed professionals and their families to a wide variety of lifestyles and locations. This has resulted in their attraction to places which satisfy their recreational and cultural interests rather than those which are optimal from an employment standpoint. Thus, persons with strong locational preferences tend to turn down transfers and job offers to areas that do not meet their lifestyle priorities (Collie, 1986).

Professional workers have a strong locational preference for large urban areas (Malecki, 1987; Pinder, 1977). Empirical findings suggest that larger cities tend to have a higher degree of concentration of scientific personnel, although it has been declining somewhat in recent years (Malecki, 1981b). Consequently, employers have found it difficult to recruit, transfer, and relocate highly trained workers to remote locations (Clark, 1981; Glasmeier, 1986; Northrup and Malin, 1985).

This preference in location can be explained, to some degree, by agglomeration economies. A wider variety of job opportunities is more likely to be present in such areas than in smaller cities, and increasingly so in recent years (Noyelle and Stanback, 1984). Within the labor market there are frequently advantages and incentives to move from one employer to another rather than working one's way up the ladder in a single organization (Holmstrom, 1971). A change in employers often necessitates a long-distance residential move, but large urban areas also give a worker the possibility of changing employers without forcing a change in residence. In their empirical study of high-tech workers and mobility, Herzog, Schlottmann and Johnson (1986) found that high-tech migrants are attracted to larger metropolitan areas. Thus, although professional workers are more mobile than the labor force as a whole, they are at the same time geographically immobile in that they are willing to live only in distinct types of places (Buswell, 1983). The supply of some types of highly paid and scarce manpower is coming to be located increasingly in areas and communities of high physical and cultural amenity, since those people in high demand can afford to be selective about where they are willing to live (Hoover, 1975).

During the 1970s public opinion polls revealed a strong location preference for small cities, towns and rural areas rather than large cities. However, as Fuguitt and Zuiches (1975) have reported, the majority of people also want these places to be within commuting distance of a large metropolitan city. Thus, one could conclude that most people desire to have the best of both urban and rural environments and are attempting to achieve this by locating outside metropolitan areas, but not too far out (De Jong, 1977).

## Quality of Life

Any discussion concerning the location of high technology industries and professional labor invariably mentions quality of life. Increasingly quality of life and/or location-fixed amenities are being used to explain migration decisions. Quality of life is broadly defined as an individual's happiness with an environment (both physical and social), including how well a place satifies an individual's needs, desires, and lifestyle preferences (Cutter, 1985). Quality of life is a subjective concept because different people desire or prefer different things from their environment and personal factors such as personality, knowledge, and experience influence an individual's image of a place (Canter, 1983).

Quality of life research has been used to explain locational decision making on the part of both individuals and firms. Migration studies in the past concentrated on the comparison of economic differences between places and that these economic differences were the dominate determinant of migration. Economists believe that quality of life factors are responsible for the wage differences between regions. Wages and land rents vary across regions according to the value firms and households place on the site-specific attributes in each region (Beeson and Eberts, 1987). Lower wages are found at locations with an attractive quality of life whereas higher wage rates are used to attract workers to areas with a less attractive quality of life. More recently, however, it has been noted that differences in economic attributes between regions may not be the only factor inducing people to move. Quality of life attributes may play a role as well (Hsieh and Liu, 1983). Liu (1975) provided evidence that the quality of life of an area is a more powerful determinant of migration than economic variables. This finding supports the proposition that people do evaluate quality of life when making locational decisions (Power, 1980).

The overall attractiveness of a city, or its quality of life, is thought to attract workers, and especially mobile skilled workers (Porell, 1982; Weinstein, Gross and Rees, 1985; Markusen, Hall and Glasmeier, 1986). In particular, professional and technical workers are considered to be attracted to good working and living conditions (Hall et al., 1986; Massey, 1984). Geographic location and the characteristics of regions--those receiving population and those sending--are believed to influence an individual's decision to migrate. As a result, these characteristics of places affect the ability of firms to attract and retain a skilled work force (Cutter, 1985). Metropolitan areas with attractive quality of life attributes have a significant competitive advantage with regard to attracting population (Porell, 1982).

Geographers have long been involved in examining the uniqueness of place, which is embodied in the concept of quality of life. Each region is unique in terms of geographic, social, and climatic conditions. Even for those areas that share common features, the quality and quantity of the site-specific characteristics may differ (Beeson and Eberts, 1987). Although quality of life is an imprecise concept, a number of specific variables are found in quality of life studies. These include population; housing (availability, quality, and cost);

cost of living; quality of health services; retail, personal services, recreational, and cultural facilities; quality of educational services; crime; climate; and pollution (Liu, 1975; Boyer and Savageau, 1985). Despite the similarities in the variables used to describe quality of life there are several problems associated with this research; (1) there is conflict over how to measure quality of life and (2) disagreement over methodology as well (Cutter, 1985). Given these two problems and the subjective nature of quality of life, the results from such studies cannot be reproduced with any consistency. Difficulties over methodology and statistical techniques have led to conflicting conclusions about quality of life. One possibility is that the attractiveness of a city is associated with a certain threshold size. Quality of life ratings tend to be higher for larger urban areas, in large part simply because they offer a greater number and variety of urban amenities (Boyer and Savageau, 1985). Conversely, other studies have indicated an inverse relationship between city size and quality of life (Cutter, 1985).

The term "quality of life" in the context of high tech is associated with an area's high tech reputation, image, or "ambiance". The image of a company or an area is very important in recruiting and retaining quality researchers, who desire to be involved in the "leading edge" of technology and research (Kleingartner and Anderson, 1987; Von Glinow, 1988). Especially attractive to professional workers are transportation accessibility, climate, cultural activities, airports, and universities (Glasmeier et al., 1984; Herzog et al., 1986). Universities, particularly those which are research oriented, are considered to be especially attractive to professional workers, since they allow workers to update and improve their skills and provide new trained personnel (Kleingartner and Anderson, 1987). Well educated specialists will not live just anywhere, preferring instead locations with similar people, a choice of job alternatives, and at least a threshold level of urban amenities (Malecki, 1987; Saxenian, 1985). Therefore high technology firms and activities are unlikely to appear everywhere. R&D at present is found predominantly in suburban settings of large urban regions. Increasingly attractive to R&D activities are the outer metropolitan fringe areas (Buswell, 1983).

## Dual Career Couples in the Professional Labor Force

Entwined in the issue of labor mobility is the recent influx of women into the labor force--a unprecedented phenomenon common to many countries of the world, and a trend not likely to disappear. The labor force participation rate for women in the United States has been increasing over the past forty years and appears to still be rising (Table 2.1). The increase of women, and particularly of married women, in the labor force is affecting many different areas of society.

Table 2.1 Labor Force Participation Rate for Women, 1955-1985

| Year | Rate |
|---|---|
| 1950 | 31.4% |
| 1955 | 34.5% |
| 1960 | 36.5% |
| 1965 | 38.1% |
| 1970 | 42.6% |
| 1975 | 45.9% |
| 1980 | 51.2% |
| 1985 | 54.1% |
| 1987 | 56.2% |

Includes full-time and part-time employment.

Source: U.S. Bureau of the Census, Statistical Abstract of the United States, 1987.

As a result, the dual career couple, with both the husband and the wife working and pursuing careers, is becoming more the norm than the exception. The Wall Street Journal (1986a) reported that dual career couples now comprise 46% of all couples in the United States. While many important social issues have been investigated, there is a surprising lack of research on two topics of interest: the effect of dual career couples on household mobility, and the resultant implications for corporate location.

Dual career couples differ from other dual worker or dual earner couples. In a dual career couple both the husband and wife tend to emphasize their profession as an important source of identity and fulfillment. Dual career couples are employed in jobs that require a high level of commitment and considerable amounts of time and energy (Bulter and Paisley, 1980). These couples are not only defined by their separate worker roles but also by their life style, which is designed to support and facilitate the continual full-time career pursuits of both partners (Klenke-Hamel, 1982). Typically, partners in dual career relationships are younger and have been married for shorter periods of time than traditional couples (Klenke-Hamel, 1982).

With job-seeking by the head of the household having been shown to be an extremely significant and potentially stressful event, job-seeking and transfers become even more stressful and complicated in dual career families (Maynard and Zawacki, 1979; Wallston, Foster and Berger, 1978). One of the greatest difficulties in coordinating two careers is the problem of geographic mobility (Poloma et al., 1981). According to Holmstrom (1971), there are two main pressures that dual career couples must face: (1) the pressure for geographic mobility and (2) the pressure for full-time and uninterrupted careers. These couples face the difficulty of finding two suitable jobs in the same geographical location, and must deal with the conflict that career advancement for one spouse is likely to be achieved at the expense of the other spouse's career (Wallston, Foster and Berger, 1978). It is advantageous, from the viewpoint of career advancement, for a person to determine his or her geographical residence independently of the interests of other members of the family. There are more employment opportunities if a person is not restricted to a single locale or labor market, but locational independence is prevented from occurring by the desire to remain a family unit. How, then, do dual career couples go about making career and location decisions?

Holmstrom (1971) has shown that the professional careers of both spouses are mutually interdependent; both the husband's and wife's decisions concerning location are affected by the spouse. The couple either (1) negotiates simultaneously for a set of positions, (2) moves taking into account the careers of both people, or (3) the wife follows the husband. In some cases husbands have followed wives

(Wallston, Foster and Berger, 1978); however, wives tend to make greater accommodations to their husband's career needs (Bryson, Bryson, Licht and Licht, 1976; Poloma and Garland, 1971; Northrup, 1988). Although both spouses' careers are seen as important, migration decisions favor the husband's career and thus determine where the couple lives (Holmstrom, 1971; Gilbert, 1985). Perhaps the typical situation is that wives would accept jobs in another town only if their husbands also received satisfactory offers, whereas the reverse was not true (Bryson and Bryson, 1978). The husband is the "trailing spouse" about 10% of the time, whereas in 90% of the cases the wife is the trailing spouse (Giddings, 1987). However, the influence on locational choice exerted by the wife's career increases as her income (and presumably her share of the household income) increases (Mincer, 1978).

Difficulties in maximizing both careers simultaneously may lead to other forms of work accommodation, such as taking turns in moving for each partner's career opportunities, or alternating working in several year cycles (Moore et al., 1980). Also, geographic constraints on the availability of optimal employment for both parties may lead to temporary separation or commuting arrangements (Bulter and Paisley, 1980; Ferris, 1978). Thus, even in the best of times, coordinating two careers -- each involving training, the pursuit of jobs and periodic job moves -- constitutes a monumental task (Larwood, Stromberg and Gutek, 1985). This difficulty arises partly because, with few opportunities open to each spouse, the possibility of finding workable combinations is slight.

There is compelling evidence to include dual career couples explicitly in the context of mobile professionals. Large urban areas appear to be the best locational options not only for professionals in general but even more so for professionals and their spouses together (Mincer, 1978). Isolated locations are at a recruiting disadvantage for dual career couples because typically only one satisfactory job will be available (Northrup, 1988). Large urban regions contain not only a larger number of job opportunities but also a wider variety of jobs. The major effect of the dual career couple may be to reinforce the agglomeration effect of large labor markets in two ways: (1) large urban areas will be more attractive when initial employment is sought, and (2) they will be more attractive locations when subsequent moves are made by increasing the likelihood that jobs may be changed without accompanying residential change (Malecki, 1987).

A city's quality of life is of importance to dual career couples as well. For dual career couples, two major concerns exist in choosing an area in which to live and work: (1) career opportunities for both spouses, and (2) the climate or lifestyle of the area (Hall and Hall, 1979). Lifestyle issues, which encompass urban, cultural, environmental, and recreational amenities, are often considered essential to retaining a satisfied professional workforce (Markusen, 1985). Only the latter will be important in the case of single career couples as well.

Dual career couples also seem to resist relocation once they have settled in a place (Sekas, 1984; Cooper and Makin, 1985; Mincer, 1978; Biggerstaffe, 1982). Higher migration rates persist for families where the wife is not employed outside the home. Thus, the labor force participation of wives has generally been found to reduce the likelihood of family migration (Parnes et al., 1975; Long, 1974; Lichter, 1982). The incidence of immobility is also great when the education, experience and earnings of the couple are both high and comparable, clearly the situation of dual career couples (Mincer, 1978). As the wife's contribution to the economic well-being of the family increases, the family becomes less mobile because the opportunity cost of moving is greater (Lichter, 1982; Speare, Kobrin and Kingkade, 1982). In evaluating a job offer that involves a move, dual career couples do not look at the individual offer alone. Rather, they examine and seek the best joint situation. The key question is which job location will offer both members of the couple the best career opportunity and the best compensation package (Greenwood, 1985).

Migration rates also diminish more strongly with distance in families where both spouses are employed. As a result, local relocation or mobility rates tend to be higher for the two-earner family. Thus, not only are dual career couples less likely to move but, when moving, they tend to move shorter distances than other couples (Bartel, 1975; Lichter, 1982).

Dual career couples are experiencing increased conflict over where to locate (Mortimer et al., 1978; Tallon, 1979; Richmond-Abbott, 1983), and organizations have begun to report increased resistance to relocation from men and women whose spouses have careers of their own (Maynard and Zawacki, 1979; McConkey, 1979; The Wall Street Journal, 1986b; Business Week, 1987). However, for corporations, resistance to relocation among dual career couples is often a hidden problem. Many workers simply refuse relocations or transfers, citing other reasons, because they do not wish to say "I'm not going to move because of my spouse's career" (Biggerstaffe, 1982). At the management level one of the biggest problems presented by the dual career couple is the refusal to relocate (Hall and Hall, 1978). According to a study conducted by the New York firm of Gilbert Tweed Associates, one in three executives cannot or will not relocate because it would interfere with the career or studies of their spouses (Hall and Hall, 1978). More recent data show that dual career couples are involved in 60% of corporate transfers (The Wall Street Journal, 1986b), and that almost three-quarters of dual career couples have encountered dual career and relocation conflicts (The Wall Street Journal, 1987). In short, transfers and relocations of dual career couples are having a great impact on corporations.

## Summary

The interrelationship between R&D facilities and professional labor and the resulting impact on corporate location is still unknown. Clearly, the contemporary view presented in the literature of labor as a exploited class differs from reality. Professional labor, with its control over knowledge and its importance to R&D, has considerable power over capital. Location inquiry is further complicated by the consideration of other influences, such as agglomeration economies, quality of life, and dual career couples.

To investigate the geographical relationship between R&D facilities and their labor force, two distinct data sets and methods of analysis will be employed in the chapters that follow. One investigation, presented in Chapter 3, utilizes census data for the continental United States to examine mobility rates, patterns, and locational preferences of professional and technical workers and dual career couples. A second inquiry, described in Chapter 4, involves survey results of individual business facilities, specifically R&D facilities, and their professional and technical employees. This two-pronged approach has several advantages. Focusing on individual firms will allow the examination of the decision making process, and identify how and on what basis locations are determined. Analysis of census data will provide insight into the national picture and suggest a wider applicability to other locations beyond those represented in the survey.

# CHAPTER 3
# PROFESSIONAL LABOR, DUAL CAREER COUPLES, AND GEOGRAPHIC MOBILITY: A NATIONAL-SCALE ANALYSIS

## Introduction

Professional and technical labor merit investigation not only because of their significance to R&D but also because professional occupations are the fastest growing segment of the labor force, a trend projected to continue (Leon, 1982). Furthermore, the composition of the professional and technical labor force has been undergoing changes which are having a profound effect on the mobility of labor and, as a result, on the location of firms. An increasing number of women have been entering the labor force in recent years and women now make up 44.4 % of the labor force in the United States (U.S. Bureau of the Census, 1988). Women perform a small, but increasingly important, role in the engineering and science professions, particularly in industrial research and development laboratories (Northrup, 1988).

Given the importance of professional workers to R&D and their increasing contribution to the labor force, it is important to examine the attributes and locational trends of professional labor. The locational preferences of the professional labor force can influence where corporations locate, and thus will determine where economic growth will occur.

This chapter examines national trends regarding professional labor mobility and location patterns. The next section outlines the research questions and methodology of the study, followed by a summary of the results. The chapter concludes with a discussion of the implications of the research findings.

## Research Design

This chapter investigates the issues of mobility and location decision-making of professional and technical labor and dual career couples by examining the following research questions.

1. Do professional and technical households differ from other households in terms of migration and locational decisions?
2. Do professional and technical workers who migrate differ from those who do not?
3. Do dual career couples differ from other professional couples in their personal characteristics, mobility, and locational decisions?

To investigate the mobility rates and locational decisions of professional and technical workers and dual career couples, the 1980 Census of Population and Housing

Public-Use Microdata Sample A was used. This data set contains a 5% sample of housing units enumerated in the 1980 census. From this large data set of approximately 4 million households, professional and technical households were identified. In this study, professional and technical workers were defined to include executive, administrative, and managerial occupations; professional specialty occupations; and technicians, and related support occupations. A complete listing of the professional and technical occupations is given in Appendix A. Excluded from the data set were professional households in which either the household head or spouse was in the armed forces, attending college, or had left the labor force (i.e. retired) during the time period 1975-1980. The resulting data base of this study consists of a total of 95,428 professional households residing within the continental United States in both 1975 and 1980.

The benefits associated with using this data set include (1) its large size, (2) it provides a means to focus on the personal characteristics of mobile professionals and dual career couples, and (3) the national trends can be examined which will allow inferences to be made to many other locations besides those in the study area discussed in Chapter 4. There are two weaknesses associated with this data set. First, the data are somewhat out of date. As a result, it is expected that the impact and number of dual career couples are underestimated relative to the situation in the late 1980s.

Second, the data set does not include all metropolitan statistical areas (MSAs). Rather, only a portion of MSAs (listed in Appendix B) are incorporated into this study. Discussion of the results of this study will first examine the professional and technical labor force, followed by a focus on dual career couples.

## Mobility of Professional Labor

At an aggregate level, households headed by a professional or technical worker are clearly different from all households in the United States. The mobility rate for professional and technical households between 1975-1980 was 27.9%, in comparison to 21.1% for all persons in the work force (U.S. Bureau of the Census, 1985). Examining the types of moves made by households with professionals, fewer moves were intrastate and more moves were made between states in comparison to all household moves (Table 3.1).

Hidden within these migration rates are notable differences among professional and technical workers across class and occupational categories. Federal government workers and private wage and salary workers have higher than average mobility rates than professional and technical workers as a whole (Table 3.2). The most mobile and least mobile professional and technical occupations are listed in Tables 3.3 and 3.4 respectively. Among professional and technical occupations, musicians and composers, airplane pilots and

Table 3.1 Type of Move by Employed Persons 1975 to 1980

| Type of Move | Professionals | Total Employed Persons |
|---|---|---|
| Intrastate | 72.4% | 77.1% |
| Interstate | 24.6% | 19.5% |
| From Abroad | 3.0% | 3.4% |

Source: U.S. Bureau of the Census, 1982.

Table 3.2 Mobility Rate and Household Type by Class of Worker

| Household Type | Private Wage and Salary | Federal Gov't | State Gov't | Local Gov't | Self Employed | Other |
|---|---|---|---|---|---|---|
| Total Households | 57057 | 5539 | 5746 | 9668 | 9604 | 7814 |
| Percentage of Total Households | 59.8 | 5.8 | 6.0 | 10.1 | 10.1 | 8.2 |
| Mobility Rate | 12.6% | 13.1% | 9.9% | 6.7% | 8.4% | 7.9% |

Average mobility rate for all workers = 11.1%

Source: Census of Population and Housing, 1980. Public-Use Microdata Sample A.

Table 3.3 Mobility Rates of Professional Occupations 1975-1980

| Most Mobile Occupations | Mobility Rate (%) |
|---|---|
| Musicians and Composers | 20.2 |
| Airplane Pilots and Navigators | 18.7 |
| Geologists and Geodesists | 17.7 |
| Forestry and Conservation Scientists | 17.0 |
| Managers, Marketing, and Advertising | 16.2 |
| Health Technologists and Technicians | 15.8 |
| Computer Programers | 15.5 |
| Management Analysts | 15.4 |
| Biological and Life Scientists | 15.3 |
| Actors and Directors | 14.8 |
| Chemists | 14.5 |
| Economists | 14.2 |
| Chemical Engineers | 14.0 |
| Librarians | 13.8 |
| Metallurgical and Materials Engineers | 13.6 |
| Officials, Public Administration | 13.5 |
| Psychologists | 13.4 |
| Editors and Reporters | 13.3 |
| Clinical Laboratory Technologists and Technicians | 13.2 |
| Financial Managers | 13.0 |
| Physicians | 12.9 |
| Purchasing Managers | 12.8 |
| Personnel and Labor Relation Managers | 12.7 |
| Teachers | 12.7 |
| Air Traffic Controllers | 12.6 |
| Engineers | 12.5 |
| Managers and Administrators | 12.4 |
| Registered Nurses | 12.3 |
| Industrial Engineers | 12.0 |
| Average mobility rate for all occupations | 11.1% |

Source: Census of Population and Housing, 1980. Public-Use Microdata Sample A.

Table 3.4 Mobility Rates of Professional Occupations 1975-1980

| Least Mobile Occupations | Mobility Rate (%) |
|---|---|
| Judges | 4.7 |
| Administrators, Protective Services | 5.6 |
| Optometrists | 5.7 |
| Chemical Technicians | 5.7 |
| Dentists | 5.8 |
| Pharmacists | 6.6 |
| Aerospace Engineer | 6.6 |
| Secondary School Teachers | 6.7 |
| Surveyors, Mapping Scientists | 6.8 |
| Elementary School Teachers | 7.8 |
| Administrators, Education and Related Fields | 7.9 |
| Engineering Technicians | 8.0 |
| Lawyers | 8.0 |
| Authors | 8.3 |
| Chief Executives and General Administrators | 8.5 |
| Science Technicians | 8.6 |
| Drafting Occupations | 8.7 |
| Counselors, Educational and Vocational | 8.7 |
| Physicists and Astronomers | 9.2 |
| Operations and Systems Researchers and Analysts | 9.2 |
| Veterinarians | 9.2 |
| Designers | 9.2 |
| Mechanical Engineers | 9.3 |
| Technical Writers | 9.9 |
| Architects | 9.9 |
| Average mobility rate for all occupations | 11.1% |

Source: Census of Population and Housing, 1980. Public-Use Microdata Sample A.

navigators, and geologists and geodesists had the highest mobility rates. Occupations with the lowest mobility rates tend to be dominated by government workers (such as judges and teachers), or self-employed workers (such as optometrists and dentists). Recall that government and self-employed workers are those which have the lowest overall mobility rates in comparison to private wage and salary workers (Table 3.2).

The data set containing professional and technical workers was divided into two groups: those professional households which moved during the 1975-1980 time period and those which remained in their 1975 location. The personal characteristics of the two professional groups--movers and nonmovers--were examined and compared using a t-test (Table 3.5). The results of this study corroborate the results of other migration studies (Ladinsky, 1967; Greenwood, 1981; Gentile and Stave, 1988). Mobile professionals are younger, have more education, and tend to have fewer children than professionals who did not move. Also, among households which moved, the husband's income tends to ba higher, but the wife's income is relatively lower than in households which did not move. From this one could infer that migration decisions during the late 1970s favored husbands' careers.

During the 1975-1980 time period the migration patterns of professional workers followed the general population trend of moving from the Northeast and North Central areas of the county to the West and South, as Shapero (1985) suggested

Table 3.5 Personal Characteristics By Mobility Status of Professional Households, 1980

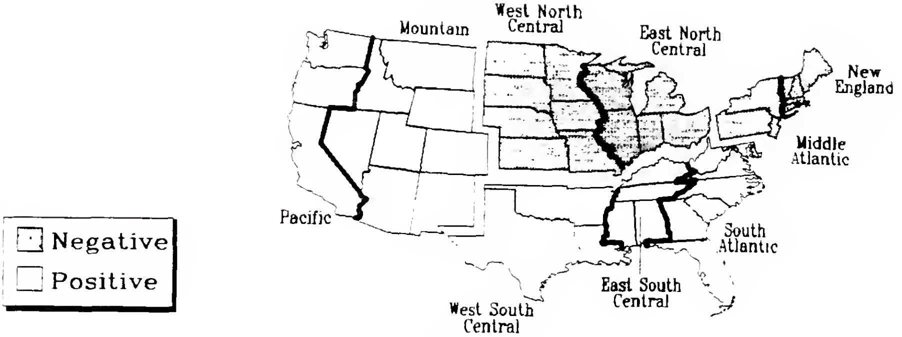
| Variable | Non-movers | Movers | |
|---|---|---|---|
| Age (husband) | 45.2 | 40.5 | ** |
| Age (wife) | 42.9 | 38.2 | ** |
| Number of children | 2.8 | 2.7 | * |
| Education (husband) | 17.2 | 17.5 | ** |
| Education (wife) | 16.1 | 16.3 | ** |
| Income (husband) | $ 21623 | $ 22112 | ** |
| Income (wife) | $ 6354 | $ 5409 | ** |
| Household income | $ 35153 | $ 32766 | ** |
| n | 84869 | 10559 | |

** significantly different at the .01 significance level
* significantly different at the .05 significance level

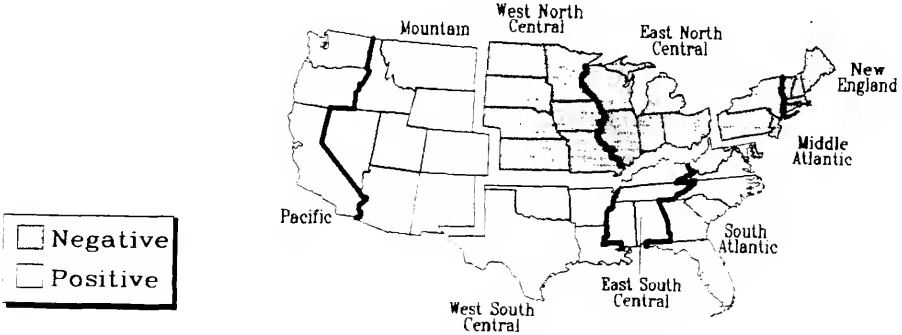
Source: Census of Population and Housing, 1980. Public-Use Microdata Sample A.

(Figure 3.1). Greatest migration flows were from the Middle Atlantic and East North Central states to the South Atlantic states. Employers compete in national markets for professional and technical workers, and between 1975-1980 areas in the south and west attracted these workers from other regions in the northeast and north central part of the country.

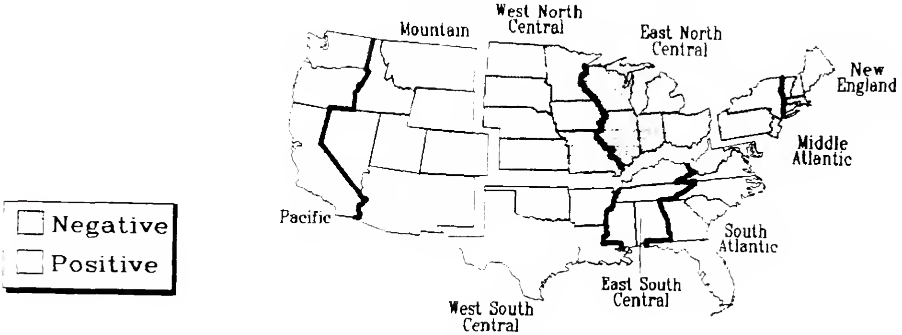
Professional and technical workers favor metropolitan centers; 87.5% of them resided in MSAs in 1980, compared to 77.0% for all employed persons (U.S. Bureau of the Census, 1982). Professionals and technicians who live outside MSAs had a slightly higher mobility rate (12.0%) than professionals who resided in MSAs (11.0%). MSAs with the greatest concentration of professional households (defined as professional households in MSA/total households in MSA) in 1980 are listed in Table 3.6. The list of MSAs represent, as Tiebout (1956) suggested, professional households voting with their feet for the locations that best satisfy their personal needs and preferences. On the whole, the cities are distributed fairly equally throughout the U.S., with every region containing at least one city. The list contains many large urban areas which correspond to R&D agglomerations identified by Malecki (1981c), such as New York, San Francisco, Chicago, Hartford, Denver, Dallas-Fort Worth, Milwaukee, Los Angeles, Houston, and Washington D.C. Several other cities listed are state capitals and are identified by Noyelle and Stanback (1984) as



Total Population



Professional and Technical Households



Dual Career Couples

Figure 3.1 Net Migration 1975 to 1980

Table 3.6 Concentration of Professional and Technical Households by MSA, 1980 (n=83)

| Metropolitan Area | Percentage of Total Households |
|---|---|
| 1. Washington D.C. | 5.27 |
| 2. Denver | 4.90 |
| 3. San Francisco | 4.58 |
| 4. Charlotte | 4.49 |
| 5. Salt Lake City | 4.27 |
| 6. Austin | 4.21 |
| 7. Richmond | 4.13 |
| 8. Raleigh | 4.11 |
| 9. Harrisburg | 4.08 |
| 10. Albany | 4.05 |
| 11. Portland | 4.02 |
| 12. Columbus | 4.01 |
| 13. Tulsa | 3.91 |
| 14. New York | 3.85 |
| 15. Orlando | 3.79 |
| 16. Chicago | 3.77 |
| 17. Sacremento | 3.73 |
| 18. Hartford | 3.71 |
| 19. Dallas-Fort Worth | 3.70 |
| 20. Phoenix | 3.69 |
| 21. Milwaukee | 3.68 |
| 22. Los Angeles | 3.67 |
| 23. Albuquerque | 3.66 |
| 24. Kansas City | 3.65 |
| 25. Houston | 3.64 |
| Average for all 83 MSAs | 3.26 |

Source: Census of Population and Housing, 1980. Public-Use Microdata Sample A.

government-education centers, including Sacremento, Austin, Raleigh, Harrisburg, Columbus, and Albany.

A regression analysis was conducted to determine how the concentration of professional and technical households increased with city size. The measure of professional employment was estimated by the following equation:

$$\log P = a + b \log H$$

where $P$ = professional and technical households; and

$H$ = total households per metropolitan area in millions.

Estimates of $b$ (elasticity) equal to 1.0 would mean that professional households are found in equal proportion in all sizes of cities. A value of $b$ greater than 1.0 would confirm the hypothesis that larger cities contain relatively more professional households than smaller cities. MSAs with populations of less than 100,000 households were excluded from the analysis. Of a total of 246 MSAs in the data set, 83 were used in this investigation. This sample of 83 MSAs provided a suitable sample size and prevented any bias occurring from the inclusion of a large number of small MSAs (those with populations of under 100,000 households). From Table 3.7, $b = 1.11$, indicating that professional households have a tendency to be found in the largest urban agglomerations.

In addition to confirming that the number of professional households increases with city size, also of significance is whether such an increase tapers off among very large cities.

Table 3.7 Relationship Between Professional and Technical Employees and City Size, 1980.

| Constant | b | b1 | b2 | $R^2$ | F value |
|---|---|---|---|---|---|
| -2.085 | 1.108<br>(36.99) | | | .944 | 1368.59 |
| -1052.27 | | 37837.34<br>(21.85) | 154.68<br>(14.48) | .929 | 885.70 |

Values in parenthesis are t-values.
All values are significant at the .05 level or better.

Source: Census of Population and Housing, 1980. Public-Use Microdata Sample A.

If so, this would indicate the presence of diseconomies of urban scale with respect to professional activities. To test this hypothesis the following function was employed:

$$P = a + b1\ H + b2\ H^2$$

The sign of b2 indicates whether professional households increase ($b2 > 0$) or decrease ($b2 < 0$) among urban areas. From Table 3.7, $b2 = 154.7$, indicating that professional employment is a increasing function of city size among large cities, which suggests increasing agglomeration of professional and technical workers in large cities. This confirms the earlier findings of Malecki (1981b), who also found that the concentration of scientists and engineers in private industry R&D labs increased among the country's largest metropolitan areas.

## Mobility of Dual Career Couples

In an effort to investigate the mobility of dual career couples relative to other professional households, the data set of households whose head or spouse was a professional or technical worker was next divided into three groups, according to the spouse's occupational status. The traditional couple household has one professional spouse and the other spouse is not employed. The dual worker couple household consists of one professional spouse and the other spouse employed full-time in a nonprofessional occupation or part-time in a professional occupation. In the dual career couple household, both spouses are employed full-time in professional occupations. Of a total of 95,428 professional households, nearly two-thirds were dual worker couple households; and about one-eighth were dual career couple households (Table 3.8).

The personal characteristics of the three couple household types are compared in Table 3.9. Overall, dual career couple households are younger, have more education, and the wife earns a higher income than in traditional or dual worker couple households. These results are consistent with the findings of other studies (Mincer, 1978; Klenke-Hamel, 1982). The mobility rates of dual career couples are higher (12.3%) than of either dual worker (11.1%) or traditional couple households (10.2%). The higher mobility rate for dual career couple households, in comparison to other households, is inconsistent with the findings of earlier studies (Mincer, 1978; Lichter, 1982). However, since migrants are younger than nonmigrants and dual career couples are significantly younger than other professional households, then differences in mobility rates may be due to age structure rather than to couple type.

Differences exist in the types of moves made by the three couple groups. Dual worker couples and dual career couples are similar in that they are more mobile within state boundaries (48%), whereas 54% of moves made by traditional couples occur between states. Traditional couples are also more likely to have moved from abroad (8.3%) than dual worker (5.2%) and dual

Table 3.8 Number of Households by Couple Type, 1980

| Traditional Couple | Dual Worker Couple | Dual Career Couple | Total Households |
|---|---|---|---|
| 22,349 | 60,635 | 12,444 | 95,428 |
| 23.4% | 63.5% | 13.1% | 100% |

Source: Census of Population and Housing, 1980. Public-Use Microdata Sample A.

Table 3.9 Means of Personal Characteristics, by Household Type

| Variable | Traditional Couple | Dual Worker Couple | Dual Career Couple | |
|---|---|---|---|---|
| Age (husband) | 49.9 | 43.5 | 42.8 | ** |
| Age (wife) | 46.7 | 41.2 | 40.5 | ** |
| Number of children | 3.0 | 2.8 | 2.8 | |
| Education (husband) | 17.6 | 16.8 | 18.3 | * |
| Education (wife) | 15.7 | 16.0 | 17.8 | * |
| Income (husband) | $ 25904 | $ 20210 | $ 21237 | |
| Income (wife) | $ 1074 | $ 6897 | $ 12385 | * |
| Household income | $ 37068 | $ 33215 | $ 39128 | |
| Mobility rate | 10.2% | 11.1% | 12.3% | |
| n | 22349 | 60635 | 12444 | |

** significantly different at the .01 significance level
* significantly different at the .05 significance level

Source: Census of Population and Housing, 1980. Public-Use Microdata Sample A.

career couples (5.7%). Therefore, dual worker and dual career couples are similar in that they are not only more mobile than traditional couples, but they also are more likely to have moved over shorter distances (within state). This may partly be explained by the differences that are present between couple type and class of worker (Table 3.10). A large proportion of dual career couples are government workers (34.8%), compared to the 22.0% average for all professional households. Only 50.6% of dual career couples are private wage and salary workers, in contrast to 59.8% for all professionals, and a smaller percentage (14.5% vs. 16.7%) of dual career couples are self employed compared to all professionals. With a large concentration of dual career couple households employed by government, particularly state and local governments, it is not surprising that dual career couples demonstrate a preference for shorter, within-state moves. Also, many professions, such as dentistry, education, law, and medicine, are licensed by each state, which would further encourage professionals to remain within state. Occupations with the greatest concentration of dual career couples are secondary and elementary school teachers, education administrators, post secondary school teachers, and social workers.

The data set was divided once again within each couple category into movers and nonmovers (Table 3.11). Within each couple group, migrants are younger, are more educated, and

Table 3.10 Class of Worker by Household Type

| Household Type | Private Wage and Salary | Federal Gov't | State Gov't | Local Gov't | Self Employed | Other |
|---|---|---|---|---|---|---|
| Traditional Couples | 57.4% | 6.0% | 4.7% | 6.7% | 10.6% | 14.6% |
| Dual Worker Couples | 62.6% | 5.8% | 5.7% | 9.5% | 10.2% | 6.3% |
| Dual Career Couples | 50.6% | 5.5% | 9.8% | 19.6% | 8.5% | 6.0% |
| Total Households | 59.8% | 5.8% | 6.0% | 10.1% | 10.1% | 8.2% |

Source: Census of Population and Housing, 1980. Public-Use Microdata Sample A.

Table 3.11 Personal Characteristics by Couple Type and Mobility Status

| Variable | Traditional Couples | | Dual Worker Couples | | Dual Career Couples | |
|---|---|---|---|---|---|---|
| | Non-Movers | Movers | Non-Movers | Movers | Non-Movers | Movers |
| Age (Husband) | 49.4 | 45.4 ** | 44.1 | 39.4 ** | 43.4 | 38.0 ** |
| Age (Wife) | 47.1 | 43.2 ** | 41.7 | 37.1 ** | 41.2 | 35.9 ** |
| Number of Children | 3.0 | 2.9 ** | 2.8 | 2.6 ** | 2.9 | 2.6 * |
| Education (husband) | 17.5 | 17.7 | 16.8 | 17.2 ** | 18.3 | 18.6 ** |
| Education (wife) | 15.7 | 15.8 ** | 15.9 | 16.2 ** | 17.8 | 17.9 * |
| Income (husband) | $ 25759 | $ 27173 ** | $ 20171 | $ 20520 * | $ 21192 | $ 21549 |
| Income (wife) | $ 1104 | $ 806 | $ 7023 | $ 5889 * | $ 12697 | $ 10161 ** |
| Household Income | $ 37251 | $ 35461 * | $ 33485 | $ 31058 ** | $ 39533 | $ 36242 ** |
| n | 20061 | 2288 | 53898 | 6737 | 10910 | 1534 |

** t-test is significant different at the .01 significance level
* t-test is significant different at the .05 significance level

have fewer children. Although not statistically significant, for all groups there is a consistent trend in households which moved between 1975 and 1980: the husband's income is slightly higher and the wife's income tends to be somewhat lower than in households which did not move. There are two possible interpretations for this trend. On one hand, in households where the wife earns a relatively lower income mobility may be more likely to take place because only the husband's career is really considered in the migration decision. Another interpretation is the trailing spouse phenomenon, in which one spouse (usually the husband) decides to move for career advancement while the other spouse (typically the wife) follows with no prearranged job at the new location. The trailing spouse phenomenon has been used to explain the fact that married women suffer wage loss after migration (Spitze, 1984). Wage loss tends to occur because the wife must search for a new job and depending on the location and opportunities available underemployment may result. Both interpretations appear to suggest that, overall, migration decisions are determined by and favor the husband's career. Dual career couples likewise follow the general population migration trends and professional worker patterns (Figure 3.1). Dual career couples during 1975 to 1980 were migrating from the Northeast and North Central section of the country to the West and South.

There is little difference between the three couple types in terms of preference for metropolitan areas; however, dual career couple households living outside MSAs had a higher mobility rate (14.1%) than dual career couples living in MSAs (12.0%) and traditional (11.5%) and dual worker couples living outside MSAs (11.8%). There is also considerable similarity in the cities (MSAs) in which professionals reside and those chosen by dual career couples (Table 3.12). Many of the cities listed, as in the case of professional and technical workers, are R&D agglomerations identified by Malecki (1981c), including Washington D.C., San Francisco, New York, Baltimore, Denver, Philadelphia, Los Angeles, Hartford, Dallas-Fort Worth, and Houston. Many are also state capitals classified by Noyelle and Stanback, (1984) as government-education centers, such as Raleigh, Austin, Albany, Harrisburg, Columbus, and Baton Rouge.

To test the hypothesis that dual career couples are more likely to be found in large metropolitan centers the following model was used:

$$\log D = a + b \log H$$

where D = dual career couple households; and

H = total households per metropolitan area in millions.

The same list of 83 MSAs were used in this inquiry as in the case above for professional and technical workers. Estimates of b (elasticity) equal to 1.0 would mean that dual career couple households are found in equal proportion in all sizes

Table 3.12 Concentration of Dual Career Couples by Metropolitan Area, 1980 (n=83)

| Metropolitan Area | Percentage of Total Households |
|---|---|
| 1. Washington D.C. | 1.04 |
| 2. Raleigh | .70 |
| 3. Hartford | .67 |
| 4. Austin | .65 |
| 5. Denver | .62 |
| 6. Columbus | .60 |
| 7. Portland | .59 |
| 8. Charlotte | .59 |
| 9. Harrisburg | .59 |
| 10. San Francisco | .58 |
| 11. Wichita | .56 |
| 12. Albany | .55 |
| 13. Seattle | .54 |
| 14. Tucson | .54 |
| 15. New York | .54 |
| 16. Nashville | .52 |
| 17. Baltimore | .51 |
| 18. Philadelphia | .50 |
| 19. Los Angeles | .50 |
| 20. Dallas-Fort Worth | .49 |
| 21. Tulsa | .49 |
| 22. Richmond | .49 |
| 23. Baton Rouge | .48 |
| 24. Houston | .48 |
| 25. Winston-Salem | .48 |
| Average for all 83 MSAs | .42 |

Source: Census of Population and Housing, 1980. Public-Use Microdata Sample A.

of cities. A value of b greater than 1.0 would confirm the hypothesis that larger cities contain relatively more dual career couple households than smaller cities. From Table 3.13, b = 1.14, indicating that dual career couple households have a tendency to be found in the largest urban agglomerations. The elasticity value for dual career couples is higher than for professionals and technicians indicating that dual career couples have a slightly greater tendency to concentrate in the largest MSAs than professionals and technical households.

Also worthy of investigation is whether diseconomies are present in large cities with respect to the attraction of dual career couples. To test this hypothesis the following quadratic function was used:

$$D = a + b1\ H + b2\ H^2$$

The sign of b2 will indicate whether the presence of dual career couples increases (b2 > 0) or decreases (b2 < 0) among large urban areas. From Table 3.11, b2 = 120.4, indicating increasing agglomeration in large cities for dual career couples, as was true as well for professional and technical occupations as a whole.

## Conclusions and Implications

The results of the analysis have provided information about the geographic distribution and characteristics of the professional and technical labor force and dual career couples. To summarize, professional and technical workers are

Table 3.13 Relationship Between Dual Career Couples and City Size, 1980

| Constant | b | b1 | b2 | $R^2$ | F value |
|---|---|---|---|---|---|
| -3.164 | 1.142<br>(28.30) | | | .907 | 800.86 |
| -124.99 | | 4835.56<br>(16.23) | 120.41<br>(12.85) | .873 | 288.00 |

Values in parenthesis are t-values.
All values are significant at the .05 level or better.

Source: Census of Population and Housing, 1980. Public-Use Microdata Sample A.

more geographically mobile than other households, but they tended from 1975 to 1980 to follow the migration paths of the population as a whole, from the Northeast and North Central areas of the country to the South and West. Mobility varies greatly with class of worker, age, education, occupation, and couple type. Among professional and technical workers migrants are younger, have more education, and tend to have fewer children. Migration appears to favor husbands' careers, since the income of heads of households is generally higher among those households who moved, while the spouses' income tends to be lower. This finding is consistent with Northrup's (1988) research, which found that most female engineers and scientists still tend to put their husbands' careers before their own. This outcome may also indicate that companies, through their managerial attitudes and actions, expect and support the trend of the wife being the trailing spouse. Rosen, Jerdee and Prestwick (1975) conducted a national sample of managers and executive responses to particular events. Their results reflected a pattern that a married women was expected to sacrifice her job for the sake of her husband's career. On the other hand, the firm typically took action to retain a male employee in the reverse situation.

Professional and technical workers favor metropolitan areas, especially large metropolitan areas. Professional labor agglomerations tend to be located in the largest urban areas. Locational preference for large urban areas on the part of professional and technical labor contradict public opinion poll results from the mid-1970s which found a strong preference for small cities, towns and rural areas rather than large cities (Fuguitt and Zuiches, 1975). However, although few people prefer to live in big cities, the majority of people want to live within commuting distance of a large metropolitan area (Fuguitt and Zuiches, 1975).

Finally, dual career couples differ somewhat from other professional couples. Overall, dual career couples follow the trends and patterns exhibited by professional and technical households, but for dual career couples these trends are intensified. Dual career couples are more mobile than other professional households, and they have a stronger locational preference for larger urban areas.

Given that the migration patterns and locational preferences of professional and technical households and dual career couples are known, yet to be answered is what this implies for corporate location. The findings suggest that future growth in professional and technical occupations and dual career couples will result in the further concentration of the population and economic activities in large urban centers. In turn, the location and relocation of corporate functions will be increasingly constrained by labor market realities. Chapter 4 will further investigate the interrelationship between professional and technical labor and R&D location.

# CHAPTER 4

# LOCATIONAL DECISION-MAKING AND PREFERENCES OF R&D FACILITIES AND PROFESSIONAL LABOR

## Introduction

Chapter 3 provided information at the national scale concerning professional and technical labor and dual career couples, their demographic characteristics, migration, and location patterns. However, the analysis and thus the results obtained in Chapter 3 contain several weaknesses. First, the data upon which the results are based are somewhat out of date, reflecting the situation in 1980 and mobility from 1975 to 1980. The labor force participation rate for women has increased from 51.5% in 1980 to 56.2% in 1987 (U.S. Bureau of the Census, 1988). Female employment in professional occupations also increased over this time period, from 40.6% in 1980 to 43.7% in 1988 (U.S. Bureau of the Census, 1988). As a result, it is expected that the number of dual career couples will have increased from 1980 to 1988. Second, professional and technical workers who are employed in R&D cannot be identified from the Census Public Use data, which identifies occupations and industries but not establishment type. Finally, aggregate data confounds important aspects of the migration decision, such as the relationship between firms and labor markets. To overcome these weaknesses, a complementary investigation was conducted to examine the locational needs and preferences of corporate R&D facilities and their employees.

The chapter is divided into three sections. The next section will review the research questions that have yet to be answered as well as the methodologies to be utilized. The second section provides the results of the investigation. The chapter concludes with a summary of the results and their implications.

## Research Design

The research questions investigated in this chapter include the following:

1. How do professional and technical workers search for employment? What kinds of places are chosen as locations by professional and technical workers? What are the favorable economic, residential, cultural, and environmental attributes of the places as identified by professional workers and how are they similar to or different from those places and attributes identified by R&D firms?
2. What kinds of places are chosen by firms as locations for R&D labs? What are the favorable economic, residential, cultural, and environmental attributes of the places as identified by the firms?

3. To what extent do firms take into account the locational preferences of their professional and technical workers when determining their R&D facility location?
4. Do dual career couples differ from other professionals? Do dual career couples constrain R&D facilities to certain types of places?
5. How do labor markets operate and influence R&D location? Do firms influence the composition of local labor markets?

To investigate these questions a nationwide study was conducted which surveyed both R&D establishments of firms and their professional and technical employees. Two questionnaires were prepared: one for the R&D facility and the other for its professional and technical workers (see Appendix C). The corporate questionnaire was designed to elicit information concerning characteristics of the firm and its R&D facility, the firm's response to the labor market, location attributes considered important to the firm and its employees, and future ideal locations. The employee questionnaire was structured to provide information on employee characteristics (e.g., age, marital status, number of children), location attributes (e.g., business and entrepreneurial climate, quality of schools), preferences, and job search activities, such as number of moves, job changes, search areas.

Firms and R&D facilities were identified and selected from the Cattell Press (1987) Directory of American Research and Technology. Facilities were chosen based on two criteria: the reported size of professional staff at the facility (a minimum staff of 80 employees was chosen to ensure an adequate response rate), and their location (priority was given to R&D labs located independently from the firm's headquarters). Centralized R&D labs located in the same city as their headquarters were given lower priority. This second criterion was used in order to reduce the influence of headquarters, thus enabling the study of R&D facility location separately from that of headquarter functions. By focusing on decentralized R&D facilities, the influence of corporate organizational needs are reduced, thus illuminating the effect of professional labor.

Questionnaires were sent to 100 R&D facilities located throughout the U.S., thirteen of which agreed to participate in the both the firm and employee portion of the study (Figure 4.1). One corporate questionnaire and typically between 25 and 125 employee questionnaires were distributed to each firm, depending on the size of its professional and technical labor force and the number of employees to whom the firm was willing to distribute questionnaires. The employee questionnaires were then distributed by each firm to its professional workers. A total of 958 employee questionnaires were sent out. The responses from thirteen firms (response rate of 13%) and 700

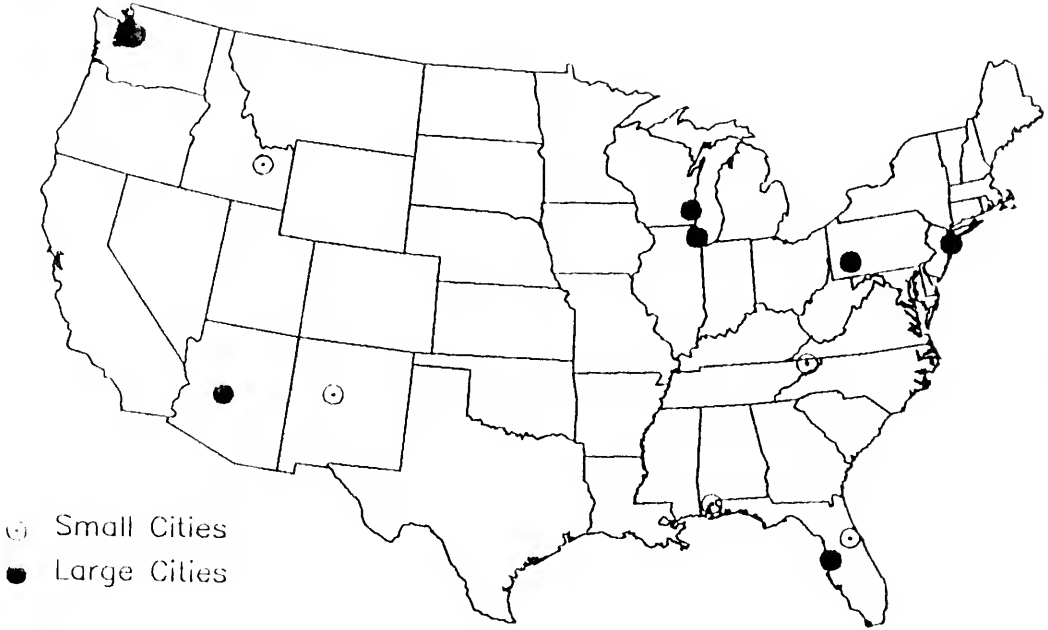


Figure 4.1 Location of R&D Facilities

employees (response rate of 73.1%) form the data base of this study. An additional ten firms did return a completed firm questionnaire but declined to distribute the employee questionnaires. It is likely that the survey response rate would have been considerably higher if firms had been asked to complete only the firm questionnaire. The request instead was for both components of the study to be agreed to. Those firms who were unwilling to take part in the study cited either internal difficulties such as mergers or take-overs taking place, personnel problems (i.e. layoffs occurring), or that they had recently participated in a survey study and were unwilling to do so again at this time. Study questionnaires were sent to and the firm questionnaire was typically completed by either the company's President, Director of Research, or R&D Manager.

Although the response rate was somewhat disappointing, responses were secured from firms located in the northeast "core R&D" section of the country and from firms in Sunbelt locations. Comparing the number and geographical representation of the firms in the sample to the total population of R&D facilities, operations in the Northeast and West are somewhat under-represented while those in the Southeast are over-represented. However, this is not expected to be a problem given the nature of the study, which focuses on urban attributes rather than comparing actual places. The next section examines the composition and characteristics of professional R&D workers within the sample and reports survey findings.

## Professional R&D Workers

Of the 700 respondents, 81.6% are male and 75.6% are married. Of the 529 professional R&D workers who are married, 322 or 60.9% have a spouse who is employed and just over half (52.8%) of the employed spouses are professionals. On average, R&D respondents have resided at their present location for 7 years. The majority of professional R&D workers (72.9%) were drawn to their present location by a new job with a new employer. Other R&D workers had moved to their present location either because of a job transfer (8.4%) or to attend university (9.0%).

Entrepreneurial tendencies are generally highest among professionals and the survey findings support this trend. Approximately half (51%) of all R&D respondents have considered starting their own business and 16.6% have actually done so. To examine the locational priorities of R&D facilities and their professional and technical workers, the data were analyzed at several levels according to couple type, age, urban attributes, and city size.

## Differences Among Couples Type

The employee data were disaggregated into three categories, based on marital status and the spouse's occupational standing, to determine if locational priorities vary among different groups of professionals, and to examine how well the survey sample corresponds with the national trends observed in Chapter 3. The three categories are married but spouse not employed (traditional couple), married spouse employed but not a professional (dual worker couple), and married with spouse an employed professional (dual career couple). For this part of the study, unmarried R&D employees were excluded, leaving 529 employee responses for this analysis. From the survey data, 39.1% are traditional couples, 28.7% are dual worker couples, and 32.1% are dual career couples. From the census data utilized in Chapter 3, 23.4% were traditional couples, 63.5% were dual worker couples, and 13.1% were dual career couples. These differences can be partly explained by the fact that 8 years separate the data sets and the number of dual career couples would be expected to have increased over this time period. This is clearly the case, since the percentage of dual career couple households more than doubled (13.1% to 32.1%) from 1980 to 1988. The data sets are sightly different, one of which examines all professional and technical workers while the other focuses exclusively on R&D professionals, which may account for some of the variation. R&D workers tend to be younger than professional workers in general and are therefore more likely to be members of dual career or dual worker households. In any event, the R&D labor force surveyed are predominately represented by workers whose spouses also work (60.8%).

The employee questionnaires provided detailed information concerning personal characteristics (age, marital status, children) and job search activities, and respondents were asked to rate (on a scale from 1 to 5; Inferior to Excellent) the attributes of their present location in terms of satisfying their own personal locational requirements. The attributes chosen reflect what are generally termed "quality of life" characteristics and include climate, cultural opportunities, job alternatives, crime rates, presence of universities, and airports. Differences among the three groups were analyzed using a t-test which compared the mean score calculated for each attribute.

The three groups of professionals vary in their personal characteristics (Table 4.1). Dual career couples are younger, have fewer children, and have switched employers more frequently than other couples. Dual career couples are less likely to be willing to accept a transfer, and they report a higher incidence of having had to compromise their career goals than other couples. These findings concur with the results reported in Chapter 3 concerning dual career couples.

The analysis of urban attributes shows that the presence of a university, restaurants and shopping, and cultural amenities are especially important in satisfying the locational priorities of dual career couples (Table 4.1).

Table 4.1 Personal Characteristics by Household Type

| Variable | Traditional Couple | Dual Worker Couple | Dual Career Couple |
|---|---|---|---|
| Age | 1.84 | 2.01 | 1.68 ** |
| Career Goals | ---- | 23.7% | 25.6% * |
| Switched Employers | 5.7% | 9.7% | 11.6% |
| Accept Transfers | 73.2% | 67.7% | 58.9% ** |
| Children | 87.1% | 73.0% | 49.4% ** |
| Locational Attributes (Scale 1 to 5) | | | |
| Number of Alternative Employers | 3.3 | 3.6 | 3.9 ** |
| Number of Alternative Employers for Spouse | 2.3 | 3.2 | 3.9 ** |
| University | 3.3 | 3.2 | 3.5 ** |
| Restaurants and Shops | 3.2 | 3.3 | 3.5 * |
| Cultural Amenities | 3.4 | 3.5 | 3.6 |
| n | 207 | 152 | 170 |

* significantly different at the .10 significance level
** significantly different at the .05 significance level

Furthermore, dual career couples rated the number of alternative employers equal in significance for both members of the couple and higher than any other couple group. This demonstrates the importance members of dual career couples place on their jobs and careers overall. By comparison, traditional couple respondents rated their job alternatives and those of their spouse below that for dual worker couples.

## The Influence of Employee Age

Professionals in different career or life cycle stages respond to different benefits, and firms that wish to attract a certain type of worker should be aware of this (Von Glinow, 1988). Thus, the employee data were disaggregated into three categories according to age: under 35 years, 35 to 45 years, and over 45. There were significant differences among the employee age groups based on personal characteristics (Table 4.2). Older employees (those over 45) are more likely to have established an independent business; they perceive a greater number of satisfactory job alternatives in their present location; and they tend to have switched employers more often than younger professionals (those under 45). As an employee's age increases, two locational attributes increase in satisfaction: the number of alternative employers and the presence of an airport. Locational attributes such as proximity to family, cost of housing, presence of a university, quality of education, and recreational

Table 4.2 Personal Characteristics by Age

| Variable | Under 35 | 35 - 45 | 46 and over | |
|---|---|---|---|---|
| Independent Business | 13.1% | 23.1% | 29.4% | * |
| Job Opportunities | 63.3% | 55.2% | 71.0% | ** |
| Switched Employers | 5.9% | 13.2% | 15.8% | |
| Locational Attributes (Scale 1 to 5) | | | | |
| Number of Alternative Employers | 3.4 | 3.4 | 3.9 | ** |
| Airport | 3.1 | 3.4 | 3.6 | ** |
| Family | 3.1 | 3.0 | 2.7 | ** |
| Recreational Opportunities | 4.1 | 4.0 | 3.9 | * |
| Cost of Housing | 4.2 | 4.2 | 4.0 | ** |
| University | 3.6 | 3.3 | 3.1 | ** |
| Quality of Education | 3.8 | 3.9 | 3.2 | ** |
| n | 371 | 237 | 120 | |

* significantly different at the .10 significance level
** significantly different at the .05 significance level

opportunities are considered less satisfactory as an employee's age increases.

## Urban Attributes

For the next area of analysis, the employee data were aggregated and mean scores were calculated for each of the locational attributes. These were then compared with the firms' rankings of their locational priorities. Of particular interest in this study was matching highly rated locational attributes of firms (as designated by the corporate representative who completed the questionnaire) with the locational attributes employees rates most highly. Table 4.3 contains the list of ranked locational attributes which firms evaluated in terms of their needs at their present site, an ideal site, and for their employees. Many factors of importance to firms at their present location, such as recreational opportunities, restaurants and shopping, environmental quality, and climate, relate more directly to satisfying the firm's labor force than serving the needs of the organization itself. The two factors which are most important to a firm at its ideal site--quality of education and environmental quality--are also the two top attributes that firms believe are most important to their employees (Table 4.3).

Spearman's rank correlation coefficients were calculated in order to measure the strength of the association between

Table 4.3 Ratings of Locational Attributes Considered Important To Firms

| Attribute | Firm Present Location | Firm Ideal Location | Employee Rating by Firm |
|---|---|---|---|
| Recreational opportunities | 4.46 | 3.77 (13) | 4.54 (4) |
| Proximity to a major airport | 4.38 | 4.31 (5) | 4.31 (7) |
| Community attitude toward business | 4.23 | 4.39 (3) | 3.46 (16) |
| Restaurants and shopping | 4.08 | 3.54 (17) | 4.08 (11) |
| Environmental quality | 3.92 | 4.46 (1) | 4.77 (1) |
| Overall business climate | 3.77 | 4.00 (8) | 3.69 (14) |
| Assessibility to firm headquarters | 3.69 | 3.85 (10) | 2.69 (24) |
| Economic growth potential | 3.69 | 3.85 (10) | 3.92 (12) |
| Climate | 3.69 | 3.38 (18) | 4.23 (8) |
| Proximity to a university | 3.69 | 4.08 (6) | 4.46 (5) |
| Cultural amenities | 3.62 | 3.77 (13) | 4.15 (9) |
| Cost of housing | 3.46 | 4.08 (6) | 4.62 (3) |
| Quality of private schools | 3.46 | 3.08 (20) | 3.31 (19) |
| Cost of living | 3.38 | 3.85 (10) | 4.38 (6) |
| Availability of professional workers | 3.31 | 4.39 (3) | 3.46 (16) |
| Quality of public education | 3.31 | 4.46 (1) | 4.77 (1) |
| Accessibility to major suppliers | 3.31 | 3.77 (13) | 2.62 (25) |
| Accessibility to market | 3.23 | 4.00 (8) | 3.31 (19) |
| Alternative employers - for spouse | 3.23 | 3.15 (19) | 3.92 (12) |
| Traffic congestion | 3.15 | 3.62 (16) | 4.15 (9) |
| Entrepreneurial venture opportunities | 2.92 | 2.92 (21) | 2.85 (23) |
| Proximity to other research facilities | 2.77 | 3.54 (17) | 3.46 (16) |
| Alternative employers - for employee | 2.77 | 2.77 (22) | 3.31 (19) |
| Proximity to other similar firms | 2.69 | 2.62 (24) | 2.92 (22) |
| Nearness to family | 2.54 | 2.69 (23) | 3.69 (14) |
| n | 13 | 13 | 13 |

Spearman's rank correlation coefficient = .57

the rankings of locational attributes firms believe to be important to employees and the attributes which are considered important to professional and technical workers at their present and ideal location (Table 4.4). The values of the coefficients are .62 and .67 respectively, indicating that firms have a good idea of what their employees desire in a location. Items highly rated by both firms and employees were cost of housing, environmental quality, recreational opportunities, climate, cost of living, and cultural amenities[1]. Furthermore, there was considerable overlap between what professional workers and firms considered to be significant in evaluating locational attributes of their present location (Table 4.5). The traits that were highly rated by both firms and employees in terms of satisfying their needs were recreational opportunities, airport, environmental quality, restaurants and shopping, climate, economic growth potential, and presence of a university. Many of the locational attributes highly rated by firms in their present location relate indirectly to the needs or locational requirements of the firm itself, but directly to the labor force on which the firm depends. With a Spearman coefficient value of .74, these findings suggest that location decisions for R&D facilities have taken into account the locational

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[1] Crime rate was inadvertently omitted from the firm questionnaire.

Table 4.4 Ratings of Locational Attributes Considered Important to Employees

| Attribute | Employee Rating by Firm | Employee Ideal Location | Employee Present Location |
|---|---|---|---|
| Quality of public education | 4.77 | 3.69 (7) | 2.89 (13) |
| Environmental quality | 4.77 | 4.11 (2) | 3.51 (5) |
| Cost of housing | 4.62 | 4.16 (1) | 3.71 (4) |
| Recreational opportunities | 4.54 | 4.02 (3) | 4.09 (1) |
| Proximity to a university | 4.46 | 3.41 (11) | 3.31 (10) |
| Cost of living | 4.38 | 3.68 (8) | 3.47 (6) |
| Proximity to a major airport | 4.31 | 3.30 (14) | 3.81 (2) |
| Climate | 4.23 | 3.93 (5) | 3.73 (3) |
| Cultural amenities | 4.15 | 3.50 (9) | 3.35 (9) |
| Traffic congestion | 4.15 | 3.94 (4) | 3.02 (12) |
| Restaurants and shopping | 4.08 | 3.37 (13) | 3.46 (7) |
| Economic growth potential | 3.92 | 3.41 (11) | 3.41 (8) |
| Alternative employers - for spouse | 3.92 | 2.72 (16) | 2.47 (17) |
| Nearness to family | 3.69 | 2.98 (15) | ---- |
| Community attitude toward business | 3.46 | 3.90 (6) | 3.13 (11) |
| Alternative employers - for employee | 3.31 | 3.50 (9) | 2.49 (16) |
| Quality of private schools | 3.31 | 2.63 (17) | 2.88 (14) |
| Entrepreneurial venture opportunities | 2.85 | 2.49 (18) | 2.64 (15) |
| n | 13 | 700 | 700 |

Spearman's rank correlation coefficient = .51

Table 4.5 Firm and Employees Ratings of Attributes of Present Location

| Attribute | Employee Present Location | Firm Present Location |
|---|---|---|
| Recreational opportunities | 4.09 | 4.46 (1) |
| Proximity to a major airport | 3.81 | 4.38 (2) |
| Climate | 3.73 | 3.69 (6) |
| Cost of housing | 3.71 | 3.46 (10) |
| Environmental quality | 3.51 | 3.92 (5) |
| Cost of living | 3.47 | 3.38 (12) |
| Restaurants and shopping | 3.46 | 4.08 (4) |
| Economic growth potential | 3.41 | 3.69 (6) |
| Cultural amenities | 3.35 | 3.62 (9) |
| Proximity to a university | 3.31 | 3.69 (6) |
| Community attitude toward business | 3.13 | 4.23 (3) |
| Traffic congestion | 3.02 | 3.15 (15) |
| Quality of public education | 2.89 | 3.31 (13) |
| Quality of private schools | 2.88 | 3.46 (10) |
| Entrepreneurial venture opportunities | 2.64 | 2.92 (16) |
| Alternative employers - for employee | 2.49 | 2.77 (17) |
| Alternative employers - for spouse | 2.47 | 3.23 (14) |
| n | 700 | 13 |

Spearman's rank correlation coefficient = .74

desires of their professional labor force in choosing their present location.

There is less similarity, however, between the attributes firms and employees desire in their ideal location, indicated by the Spearman coefficient of .54 (Table 4.6). In terms of an ideal location, firms consider environmental quality, quality of education, availability of professional and technical workers, community attitude toward business, and presence of an airport most important. On the other hand, employees consider cost of housing, crime rate, environmental quality, recreational opportunities, and traffic congestion important locational attributes for an ideal location.

From Tables 4.3 and 4.4 Spearman rank correlation coefficients were calculated to measure the relations between the firms's present and ideal location and the assication between the employee's rankings of their present and ideal location. Spearman's coefficients values of .57 and .51 suggest that both R&D facilities and employees in choosing their present location have had to compromise somewhat from their ideal location. Firms are not free to choose their "ideal" R&D location, but must take into account their professional and technical employees' demands for certain locational attributes. R&D employees likewise are not free to locate at their "ideal" location but are constrained by the location of job opportunities.

Table 4.6 Firm and Employees Ratings of Attributes of their Ideal Location

| Attribute | Employee Ideal Location | Firm Ideal Location |
|---|---|---|
| Cost of housing | 4.16 | 4.08 (5) |
| Environmental quality | 4.11 | 4.46 (1) |
| Recreational opportunities | 4.02 | 3.77 (9) |
| Traffic congestion | 3.94 | 3.62 (11) |
| Climate | 3.93 | 3.38 (13) |
| Community attitude toward business | 3.90 | 4.39 (3) |
| Quality of public education | 3.69 | 4.46 (1) |
| Cost of living | 3.68 | 3.85 (7) |
| Cultural amenities | 3.50 | 3.77 (9) |
| Alternative employers - for employee | 3.50 | 2.77 (17) |
| Proximity to a university | 3.41 | 4.08 (5) |
| Economic growth potential | 3.41 | 3.85 (7) |
| Restaurants and shopping | 3.37 | 3.54 (12) |
| Proximity to a major airport | 3.30 | 4.31 (4) |
| Nearness to family | 2.98 | 2.69 (18) |
| Alternative employers - for spouse | 2.72 | 3.15 (14) |
| Quality of private schools | 2.63 | 3.08 (15) |
| Entrepreneurial venture opportunities | 2.49 | 2.92 (16) |
| n | 700 | 13 |

Spearman's rank correlation coefficient = .54

## City Size

To examine the significance of urban size and agglomeration, the data were divided into two categories according to city size. Those firms and their employees located in urban areas with populations of under and over one million were classified as residing in "small" and "large" urban areas, respectively. Of the thirteen firms in the study, five were located in small cities and eight were located in large urban areas. The labor markets of large and small urban areas differ significantly (Table 4.7). Firms located in small urban areas report a slightly higher employee turnover rate and greater difficulty in attracting employees with employed spouses. Firms located in large urban areas prefer to hire experienced employees, whereas firms in smaller cities prefer either new college graduates or state no preference. Firms in large cities also are more likely to offer employment assistance to a trailing spouse than firms located in small cities. Firms in both locations report difficulty in transferring employees with employed spouses.

There were significant differences among the employees when distinguished by city size in terms of personal characteristics as well (Table 4.8). A greater percentage of employees with working spouses and dual career couples are located in larger urban areas, which supports the national data results reported in the previous chapter. A greater number of dual career couples are located in large urban areas

Table 4.7 Characteristics of Local Labor Force

| Variable | Firms in Small Centers | Firms in Large Cities | |
|---|---|---|---|
| Turnover Rate | 5.6% | 5.1% | |
| Prefer Experienced Personnel | 20.0% | 62.5% | ** |
| Prefer New College Graduates | 40.0% | 12.5% | * |
| No Preference | 40.0% | 25.0% | * |
| Difficulty Attracting Employees With Employed Spouse | 60.0% | 14.3% | ** |
| Difficulty Transferring Employees With Employed Spouse | 60.0% | 57.1% | |
| Employment Assistance For Spouses | 40.0% | 71.4% | ** |
| n | 5 | 8 | |

* significantly different at the .10 significance level
** significantly different at the .05 significance level

Table 4.8 Personal Characteristics of Employees

| Variable | Employees in Small Centers | Employees in Large Cities | |
|---|---|---|---|
| Married | 75.3% | 76.0% | |
| Spouse Employed | 43.2% | 52.4% | * |
| Dual Career Couple | 23.6% | 30.4% | * |
| Switched Employeers | 4.4% | 16.9% | ** |
| Importance of Job Opportunities | 66.8% | 56.2% | * |
| Job Opportunities Available | 41.5% | 43.7% | |
| Job Opportunities For Spouse | 52.5% | 64.2% | * |
| Accept Transfer | 75.8% | 55.7% | ** |
| Remain in Area After Job Loss | 41.3% | 65.7% | ** |
| n | 369 | 331 | |

* significantly different at the .10 significance level
** significantly different at the .05 significance level

than smaller centers. Employees residing in the larger urban areas report a greater number of satisfactory job alternatives for themselves and their spouses. Employees in large urban areas have switched employers more often, believe they would be less likely to accept a job transfer and, if they lost their job, would tend to remain in the area. Employees located in smaller urban areas place greater importance on the job alternatives available in an area. Typically where jobs are scarce, which is more likely the case in smaller centers, jobs are more highly valued by workers (Doeringer, 1984). Furthermore, employees in small centers are more willing to accept a transfer and, if they lost their job would tend to leave the area to seek employment elsewhere.

The attractions of small and large cities are very different as perceived by the professional workers. When asked to rate their present location in terms of how well it met their personal needs, there was very little similarity between what employees in large urban areas are satisfied by and those cited by employees in small centers, demonstrated by the Spearman coefficient of .56 (Table 4.9). Employees in large urban areas favorably ranked those attributes that are associated with large urban regions, such as presence of an airport, recreational opportunities, restaurants and shopping, cultural amenities, and presence of a university. Employees located in small centers are most satisfied by those attributes associated with small cities, such as cost of

Table 4.9 Locational Attributes Important to Employees (Present Site)

| Attribute | Employees in Small Cities | Employees in Large Cities | |
|---|---|---|---|
| recreational opportunities | 4.05 | 4.13 | (2) |
| climate | 3.95 | 3.47 | (8) |
| cost of housing | 3.84 | 3.56 | (7) |
| environmental quality | 3.64 | 3.35 | (10) |
| cost of living | 3.50 | 3.43 | (9) |
| airport | 3.38 | 4.28 | (1) |
| traffic congestion | 3.36 | 2.63 | (17) |
| economic growth potential | 3.21 | 3.63 | (6) |
| crime rate | 3.18 | 3.00 | (13) |
| restaurants and shopping | 3.11 | 3.87 | (3) |
| university | 2.98 | 3.69 | (5) |
| cultural amenities | 2.97 | 3.78 | (4) |
| community attitudes | 2.96 | 3.32 | (11) |
| quality of education | 2.68 | 3.12 | (12) |
| entrepreneurial opportunities | 2.53 | 2.76 | (14) |
| venture capital | 2.39 | 2.58 | (18) |
| job alternatives | 2.30 | 2.70 | (16) |
| job alternatives for spouse | 2.24 | 2.74 | (15) |
| n | 369 | 331 | |

Spearman's rank correlation coefficient = .56

housing, environmental quality, cost of living, traffic congestion, and crime rate.

Responses from the two types of locations converged, however, with a Spearman coefficient of .91 when employees were asked to rate locational attributes important in considering an "ideal" location (Table 4.10). Therefore, professional and technical employees are similar in their preferences, if not their actual locations. Regardless of the size of their place of residence, all professionals consider environmental quality, cost of housing, recreational opportunities, crime rate, climate, community attitudes, and traffic congestion important attributes in choosing a possible future location.

When comparing the association of the attributes which are important to employees in small and large cities at their "ideal" and present site (Tables 4.9 and 4.10), there is a much stronger relationship between the rankings for employees in small cities (with a Spearman coeficient of .72) than for employees in large cities (Spearman coeficient = .07). This finding supports the results of public opinion polls which have found a strong preference for small cities and towns over large cities (Fuguitt and Zuiches, 1975). This may also suggest that it is the lure of job opportunities which attract professionals to large urban areas rather than quality of life considerations.

Table 4.10 Locational Attributes Important to Employees (Ideal Location)

| Attribute | Employees in Small Centers | Employees in Large Cities | |
|---|---|---|---|
| cost of housing | 4.15 | 4.16 | (3) |
| environmental quality | 4.05 | 4.19 | (2) |
| crime rate | 4.04 | 4.20 | (1) |
| recreational opportunities | 4.00 | 4.05 | (4) |
| climate | 3.93 | 3.92 | (7) |
| traffic congestion | 3.90 | 3.96 | (6) |
| community attitudes | 3.81 | 3.99 | (5) |
| quality of education | 3.80 | 3.57 | (11) |
| cost of living | 3.73 | 3.64 | (10) |
| university | 3.51 | 3.31 | (15) |
| airport | 3.43 | 3.42 | (14) |
| cultural amenities | 3.36 | 3.65 | (9) |
| job alternatives | 3.32 | 3.69 | (8) |
| economic growth potential | 3.32 | 3.51 | (12) |
| restaurants and shops | 3.30 | 3.46 | (13) |
| nearness to family | 3.01 | 2.92 | (16) |
| job alternatives for spouse | 2.62 | 2.82 | (17) |
| entrepreneurial opportunities | 2.45 | 2.54 | (18) |
| venture capital | 2.14 | 2.12 | (19) |
| n | 369 | 331 | |

Spearman's rank correlation coefficient = .91

In a similar outcome, firms located in large urban areas highly rated those attributes of their present location that are associated with large cities and rate those attributes as highest priority for their ideal location as well (Tables 4.11 and 4.12). Items considered important to firms located in large urban areas were airport, restaurants and shopping, recreational opportunities, university, and cultural amenities. This list corresponds closely with those attributes rated highly by the firms' employees, shown by the Spearman coefficient of .76. For these firms, an "ideal" location involves two factors that reinforce their choice of a large urban area: availability of professional and technical workers and accessibility to firm headquarters. These findings are consistent with the literature and other studies (Malecki, 1987).

Firms located in small urban areas highly rated those factors associated with small city size as important (Tables 4.11 and 4.12). In the evaluation of a future location, such attributes as quality of education, airport, university, professional workers, and cultural amenities are considered important. These items suggest that quality of life factors are salient to firms choosing to locate in small centers, but certain amenities generally associated with a threshold city size must be present. These factors include infrastructure such as universities, and airports, and availability of professional workers. The results show that while some R&D

Table 4.11 Locational Attributes Important to Firms in Present Location

| Attributes | Firms in Large Cities | Firms in Small Centers | |
|---|---|---|---|
| airport | 4.75 | 3.80 | (5) |
| restaurants and shops | 4.38 | 3.60 | (6) |
| recreational opportunities | 4.25 | 4.80 | (1) |
| community attitudes | 4.25 | 4.20 | (2) |
| university | 4.13 | 3.00 | (14) |
| economic growth potential | 4.00 | 3.20 | (12) |
| environmental quality | 3.88 | 4.00 | (3) |
| business climate | 3.88 | 3.60 | (6) |
| cultural amenities | 3.88 | 3.20 | (12) |
| firm headquarters | 3.75 | 3.60 | (6) |
| professional workers | 3.75 | 2.60 | (20) |
| job alternatives for spouse | 3.75 | 2.40 | (23) |
| quality of education | 3.63 | 2.80 | (18) |
| climate | 3.50 | 4.00 | (3) |
| cost of housing | 3.50 | 3.40 | (10) |
| proximity to suppliers | 3.50 | 3.00 | (14) |
| cost of living | 3.38 | 3.40 | (10) |
| proximity to markets | 3.38 | 3.00 | (14) |
| traffic congestion | 3.38 | 2.80 | (18) |
| entrepreneurial opportunities | 3.13 | 2.60 | (20) |
| proximity to other research facilities | 2.88 | 2.60 | (20) |
| job alternatives | 2.63 | 3.00 | (14) |
| proximity to similar firms | 2.50 | 3.00 | (14) |
| nearness to family | 1.88 | 3.60 | (6) |
| n | 8 | 5 | |

Spearman's rank correlation coefficient = .49

Table 4.12 Locational Attributes Important to Firms at Ideal Location

| Attributes | Firms in Large Cities | Firms in Small Centers | |
|---|---|---|---|
| professional workers | 4.38 | 4.40 | (6) |
| environmental quality | 4.38 | 4.60 | (3) |
| firm headquarters | 4.25 | 3.20 | (20) |
| community attitudes | 4.25 | 4.60 | (3) |
| cost of housing | 4.13 | 4.00 | (9) |
| quality of education | 4.13 | 5.00 | (1) |
| airport | 4.00 | 4.80 | (2) |
| business climate | 4.00 | 4.00 | (9) |
| proximity to markets | 4.00 | 4.00 | (9) |
| economic growth potential | 3.88 | 3.80 | (16) |
| university | 3.75 | 4.60 | (3) |
| cost of living | 3.75 | 4.00 | (9) |
| recreational opportunities | 3.63 | 4.00 | (9) |
| proximity to suppliers | 3.50 | 4.20 | (7) |
| cultural amenities | 3.50 | 4.20 | (7) |
| traffic congestion | 3.50 | 3.80 | (16) |
| other research facilities | 3.25 | 4.00 | (9) |
| restaurants and shops | 3.25 | 4.00 | (9) |
| climate | 3.13 | 3.80 | (16) |
| entrepreneur opportunities | 2.88 | 3.00 | (22) |
| job alternatives | 2.75 | 2.80 | (23) |
| job alternatives for spouse | 2.75 | 3.80 | (16) |
| proximity to similar firms | 2.38 | 3.00 | (22) |
| nearness to family | 2.38 | 3.20 | (20) |
| n | 8 | 5 | |

Spearman's rank correlation coefficient = .64

facilities are willing to locate in small urban areas--notably those areas with high quality of life attributes--certain significant urban amenities are crucial.

However, there is little similarity between the attributes highly ranked by firms in smaller centers when compared to those highly rated by their employees (Spearman coefficient = .34). This finding appears to suggest that R&D employees locational preferences are best satisfied by large urban areas and this may help to explain the relationships identified between city size and labor markets.

## City Size and Labor Markets

The responses from the ten firms which returned only the firm questionnaire were aggregated with the other thirteen firms and were distinguished by city size. Of the total of twenty-three firms, seven were classified as residing in small urban areas (those with populations under one million) and sixteen were located in large urban areas (cities with populations of over one million). The following analysis was conducted to see if the trends from the larger data set are consistent with those observed with the smaller sample and if any inferences could be made regarding labor markets of small and large urban areas.

The trends observed from this larger data set are consistent with the findings already reported. The local labor markets in small and large urban areas differ significantly

(Table 4.13). Firms located in large centers reported a slightly higher turnover rate of personnel, and overwhelmingly prefer to recruit experienced personnel than firms in small centers. Conversely, firms in small cities prefer to recruit new college graduates, and they report greater difficulty in attracting employees with spouses who work. Firms located in both large and small cities report difficulty in transferring employees with an employed spouse. Two-thirds of firms in large cities provide at least some sort of spouse employment assistance whereas less than half of firms located in small centers do so.

Differences in local labor markets by city size suggest that firms may choose locations based on local labor market characteristics. The next chapter will further explore the interrelationship between R&D firms and local labor markets.

## Significance of Universities

Finally, ties with local universities appear to play a significant role for firms in small as well as large cities. The role and significance of universities as a locational factor has been hotly debated in the research literature. Although most studies believe and include universities as a significant factor (Markusen et al., 1986; Lund, 1986; Dorfman, 1983; Farley and Glickman, 1986), a few disclaim their importance (Howells, 1986). Research has further distinguished universities classifying and identifying the top

Table 4.13 Characteristics of Local Labor Markets

| Variable | Firms in Small Centers | Firms in Large Cities | |
|---|---|---|---|
| Turnover Rate | 5.7% | 9.1% | |
| Prefer Experienced Personnel | 28.6% | 56.3% | ** |
| Prefer New College Graduates | 42.9% | 6.3% | ** |
| No Preference | 28.6% | 31.3% | |
| Difficulty Attracting Employees With Employed Spouse | 57.1% | 40.0% | |
| Difficulty Transferring Employees With Employed Spouse | 60.0% | 57.1% | |
| Employment Assistance For Spouses | 42.9% | 66.7% | * |
| Ties With A Local University | 85.7% | 100% | |
| University Ties For Employee Recruitment | 57.1% | 75.0% | |
| University Ties For Research Information | 71.4% | 81.3% | ** |
| n | 7 | 16 | |

* significantly different at the .10 significance level
** significantly different at the .05 significance level

research universities as significant in terms of access to research information and employee recruitment (Malecki, 1984; Millar and Cote, 1985). MIT in Boston, Stanford and Berkeley in California, and Cambridge University in Britain are illustrations of major research universities proven to be responsible for the attraction of firms and personnel (Dorfman, 1983; Saxenian, 1985; Segal, 1988). The findings from Table 4.13 support this belief that universities play a role in influencing the location of R&D facilities. However, in contrast to the literature, the findings suggest that the presence of a local university is significant because it allows scientific and technical personnel the opportunity to upgrade their skills and avoid obselence. The availability of continuing education programs are of particular importance to R&D employees and firms, even the university is not "top-notch" (Rosenberg, 1985; Miljus and Smith, 1987). At the same time, R&D facilities maintain ties with distant major research universities for access to research information and employee recruitment. Firms can maintain contacts with universities and other research facilities over long distances and therefore do not necessarily need to be within close proximity (Howells, 1986). These results support Noyelle and Stanback (1984) who found that R&D was concentrating near high educational institutions. This suggests that although some R&D facilities have been able to decentralize to smaller city locations, only cities with a university tend to be chosen.

Thus, the presence of a university is an important locational amenity to R&D facilities.

## Conclusions

Although the locational factors considered important to R&D facilities differed from those preferred by their professional labor force, the factors desired by both can be best satisfied by large urban areas. When asked about city size, most of the respondents preferred smaller or same size cities, yet the attributes they desire in a location tend to be found only in large places. Locational priorities and preferences differ among household groups, with dual career couples particularly constrained by and attracted to the advantages of large metropolitan centers.

In making location decisions, both firms and employees may have to compromise somewhat from choosing their "ideal" location. Large urban agglomerations are favorable sites because they offer a large professional and technical labor force and accessibility to firm headquarters. Smaller centers offering a high quality of life can also prove to be acceptable sites only if such factors as a university, airport, and professional labor force are present.

Local labor markets differ significantly with city size. This finding suggests that firms take advantage of labor market differences in choosing their location. The next chapter will examine the relationship between firms and labor markets and what this may imply for corporate location and regional economic development.

# CHAPTER 5
# LOCATION THEORY, LABOR MARKETS AND ECONOMIC DEVELOPMENT

## Introduction

Professional and technical workers have more market power than any other type of worker. This is due in large part to the fact that professionals are seen as more loyal to their profession than to their firm or employer (Osterman, 1984). As a result, professionals can often transfer from one firm to another or even between industries, yet remain in their career profession, which may be advertising, chemistry or electrical engineering. Job mobility which is typically penalized under industrial arrangements tends to provide rewards for professional workers. Professional workers enjoy greater job and geographical mobility in comparison to other types of workers. Their skills and knowledge, while specialized, are not firm specific (Osterman, 1984).

This study has thus far examined the characteristics and mobility patterns of professionals and dual career couples, and the locational decisions of R&D employees and facilities. The research findings of Chapters 3 and 4 contain considerable implications regarding corporate location. This chapter will review the findings and discuss their significance regarding location theory, labor markets, and regional economic development.

## Location Theory

Location theory in the Marxian perspective considers labor to be a central factor in determining the distribution and movement of industry (Storper and Walker, 1983). Labor is an important locational factor to corporations because of its degree of spatial differentiation (Cooke, 1983; Massey, 1984). Over time, corporations have become less restricted in space because variations in the availability, cost, and quality of some influencing factors, such as transport costs and raw materials, have been reduced. But having the capability of locating in more dispersed areas is not sufficient cause for doing so (Walker and Storper, 1981). The deconcentration of R&D is very complex and the purpose of this research has been to gain further insight into the processes responsible for the dispersal of R&D.

Labor is the main differentiating factor among regions and localities and firms take advantage of and reinforce this differentiation (Walker and Storper, 1981). Industrial geographers have long acknowledged that the type and quantity of labor varies over space as a consequence of the decisions of firms. The result is commonly referred to as the spatial division of labor. Labor can be distinguished into three categories: professionals, and skilled and unskilled nonprofessional workers. Each segment is differentiated by skills, power over production, work conditions, and location. These three segments of labor correspond to three different, discontinuous labor markets (Cooke, 1983). Workers are unable to move among segments because firms and occupations have rules of entry (McKay and Whitelaw, 1977; Cooke, 1983). These labor markets, while bounded and separated hierarchically by skills, coexist spatially (Massey, 1984).

Unskilled labor is found virtually everywhere (Clark, 1981; Massey, 1984). Routine, standardized production, and assembly operations of firms requires no special work skills, and employers seek out unskilled labor. In choosing their location these operations evaluate places based on the characteristics of the labor force--labor availability, cost, and militancy (Massey, 1984). Unskilled workers tend to be relatively fixed in location. They thus have little bargaining power, wages are low, employment is unstable, and the prospects for advancement are slight.

Skilled workers are also found at a large number of locations, but their skills tend to be either firm- or industry-specific. This specificity renders them dependent on employers so, like unskilled workers, they tend to be spatially immobile and to have little control over their work environment. Wages tend to be higher than for unskilled workers and employment is fairly stable, however, layoffs can occur.

Professions are characterized by high wage rates, job stability, and a high degree of autonomy over the work environment. Skills and knowledge are not firm- or industry-specific and, as a result, professionals have strong bargaining position (Osterman, 1984). Professionals are also highly mobile geographically. Their mobility allows them to evaluate places selectively. In addition to the larger labor markets found in major urban centers, professionals are strongly influenced by the perceived quality of life of the residential environment, and thus are concentrated in a subset of these metropolitan centers. Because of urban size and agglomeration, skilled and unskilled workers are also found at virtually all of the same locations as professionals. While routine production facilities are interested in finding sites with large quanities of cheap labor, higher order firm functions, such as headquarters or R&D facilities, are more concerned with the availability and quality of labor. In this way firms functionally separate facilities as a means of taking advantage of and segmenting labor groups (Clark, 1981). Spatial separation results from locating routine production in sites remote from major cities and professional activities.

The spatial division of labor argument differentiates locations and labor markets according to skills, behavior, and cost (Morgan and Sayer, 1988). The spatial division of labor has been used to explain the movement of manufacturing and other routine operations to peripheral areas and developing countries because of the availability of cheap abundant unskilled labor and the absence of unions in those locations. Higher order functions such as headquarters, R&D, and marketing, on the other hand, will tend to locate and remain concentrated in major urban centers of advanced countries because of their dependence on scarce highly skilled labor. However, the findings from this research and from other recent studies indicate that this impression of the spatial division of labor, although correct, is too narrow and static (Sayer, 1985; Scott, 1987; Morgan and Sayer, 1988). The theory fails to consider the possibility of change in the spatial location of labor, despite a variety of changes taking place. As one example, location theory fails to explain or account for the decentralization trend of R&D.

Glasmeier (1988) proposes that the decentralization of R&D facilities from core regions is partly the result of the creation of "technical branch plants," which are defined as stand-alone profit centers with related R&D attached. The R&D facilities that have decentralized differ from those which have remained concentrated in core areas. Case studies show that much of the R&D conducted at decentralized sites is applied, focused on development rather than research, and oriented to existing product adaptations for customers (Glasmeier, 1988). These technical branch plant operations employ not only professional and technical workers but nontechnical workers as well. Thus, firms select communities based on their ability to provide an adequate supply of both types of workers. In this way, the presence of large relatively diverse labor markets are the reason for the decentralization of these R&D facilities (Glasmeier, 1988).

The R&D facilities that have decentralized therefore differ from centralized R&D facilities in both the type of R&D they perform and their labor force needs. Some firms have been forced to decentralize a portion of their R&D facilities because of increasing land and labor costs present at their headquarter site, as illustrated in the case of the semiconductor industry, which developed and has remained concentrated in Santa Clara County, California better known as Silicon Valley (Saxenian, 1984). Today it is still the site of corporate headquarters, sophisticated research, design, and development operations, but the largest companies have been dispersing their manufacturing operations and some R&D to distant locations (Saxenian, 1984). Locating R&D and manufacturing together helps to reduce problems in product development. These joint manufacturing and R&D facilities--technical branch plants--were shifted to decentralized locations in order to take advantage of their labor markets or availability of both professionals and low-wage workers and their urban amenities, such as quality of life and low cost of living (Saxenian, 1984; Glasmeier, 1988). Routine semiconductor manufacturing and assembly operations had previously been moved offshore to Third World countries. Scott

(1987), in his examination of the semiconductor industry in South-East Asia, observed that over time more complex activities have been relocated out of the core to offshore locations. Scott's reasoning for this occurrence is the improvement of labor skills and an evolution of a division of labor in peripheral areas. The decentralization of R&D operations observed in the U.S. may be a response to similar changes taking place, with labor skills becoming more widespread geographically.

The results of this study help support the hypothesis that the decentralization of R&D facilities is the result of firms following the locational preferences of their highly skilled labor force. The findings from Chapter 4 suggest that firms, in choosing the present location for their R&D facility, have taken into account the locational priorities of their professional labor force despite organizational pressure for other locational factors (Lund, 1986). Many of the locational attributes considered important by firms in their present location related only indirectly to the needs or locational requirements of the firm itself, but directly to the labor force on which the firm depends.

The findings from other studies further support this view. In their study of the electronics industry in Britain, Morgan and Sayer (1988) reported that a R&D branch of a defense firm was obliged to shift its location to the prevailing pattern of its employees. Furthermore, they concluded that the concentration of the electronics industry in the Southeast is a cause and consequence of professional labor. The concentration of the aerospace industry in the Bristol region of Britain is largely attributable to the ability of firms to attract and retain highly qualified staff (Boddy and Lovering, 1986). Scott (1988a) observed that quality of life factors are attractive to skilled scientific and technical workers. Thus firms who depend on professional and technical workers have no option but to follow the locational inclination of their main labor force to these favored sites (Scott, 1988a).

The success of R&D programs depends on the quality and skills of the facility's work force. Labor with the necessary technical and scientific skills was once abundant, but with the general rise of technical knowledge in all industries and increasing global competition professional labor markets have tightened and in some occupations shortages have appeared (Morgan and Sayer, 1988; Schwartz, 1989). Professional and technical workers have considerable bargaining power because of the general scarcity of their skills and their ability to switch employers and industries with relative ease. These workers are thus able to be more selective in choosing their employer and location (Massey, 1984). Also, wage rates for more educated workers (which includes all professional workers) do not vary significantly among local labor markets but are rather generally consistant over larger geographical areas (Topel, 1986). Because compensation levels vary only slightly, professionals tend to distinguish locations according to quality of life factors rather than wage rates (Morgan and Sayer, 1988).

Firms have a variety of different techniques for dealing with labor difficulties, including hiring temporary help, subcontracting, job redesign, creation of new job ladders or training programs, pirating, or spatial relocation (Clark, 1981; Osterman, 1984). However, spatial relocation has recently been a favored strategy (Scott and Angel, 1987). The decentralization of R&D and other corporate operations is a means by which firms can re-create the employment relation anew (Clark, 1981; Storper and Walker, 1983). However, the fact that decentralization has been favored over other strategies suggests that factors besides labor may play a role in determining the location of R&D. The impact of these other factors will be discussed later on regional economic development.

The attributes of places in which R&D and other facilities are located can often exacerbate recruitment and retention problems, including hiring, relocation, and transferring employees. In California the high cost of housing around San Francisco and Los Angeles has resulted in professionals being reluctant to relocate there from other parts of the country (Northrup and Malin, 1985). City size plays a critical role; there are advantages and disadvantages to both firms and employees with regard to city size and the size of the local labor market. Labor markets vary substantially by type of worker, occupation, establishment size, industry, and type of area (core versus periphery) (Doeringer, 1984). From Chapter 4, it was observed that the labor market dynamics of large and small cities differ significantly. Corporate activities are not independent of the operations of local labor markets, but rather, the two are interdependent in terms of location. Capitalists or firms through their actions of recruitment and layoffs alter both the location and the conditions of labor. In order to better understand and explain why R&D concentrates in metropolitan locations, labor market theory and corporate recruitment practices need to be examined.

## Recruitment and Labor Market Theory

Corporations influence and determine the content of local labor markets through their recruiting practices and preferences. The degree of influence will depend primarily on whether firms recruit from the local labor market or seek employees nationally and internationally. Industries spend large amounts of money to recruit engineers and scientists. The knowledge and expertise of each employee contributes to the firm's competitiveness and profitability (Northrup and Malin, 1985). The development of a successful recruitment program is an important and difficult task in a competitive environment. Given the relative mobility of professional and technical workers, labor markets for professionals are national or international in scope. Firms can and indeed do attract workers to their locations from all over the world. However, because these workers have skills that are relatively easy to transfer to another company or industry, they can be difficult for the firm to retain. In this way, a recruitment program must be complemented by policies which induce professionals to remain with the firm if recruitment is to be regarded as successful and profitable.

Firms influence the composition of local labor markets through recruitment. By establishing new facilities at "greenfield sites" firms are able to create conditions of employment without being constrained by pre-existing labor markets (Walker and Storper, 1981). There are two main sources from which a company may recruit: new college graduates and experienced personnel. The firm's mix or preference for personnel will depend upon the company's philosophy, the firm's environment, and the local labor market, and these will in turn, determine the internal structure of the firm (Kanter, 1984; Northrup and Malin, 1985). A preference for new college graduates implies the presence of a well-developed internal labor market reflecting "promote from within" employment policies (Osterman, 1984). Internal labor markets entail long-term employee development strategies which provide clear, visible job ladders for career advancement. The issue of migration is often intertwined with career development and internal labor markets.

McKay and Whitelaw (1977) and Keowan (1971) show that a considerable amount of migration is attributed to movement within an organization in response to career development and opportunities. Large corporations have operations in a number of different locations, which perform specific tasks and serve particular markets. Professional staff are often transferred between various parts of the organization in order to increase their exposure and experience and give them a better appreciation of the workings of the organization (McKay and Whitelaw, 1977; Tallon, 1979). It is generally believed that this wider exposure will lead to a higher innovative capacity among workers (Zaltman, Duncan and Holbek, 1973).

The development of internal labor markets provides an incentive to employees to remain with the company. It conveys a sense of fair play and career paths are identifiable and known (Osterman, 1984). Internal labor markets can also be used as means to build-up company loyalty. The commitment to internal labor markets requires investment in training and education, exposing graduates to a broad variety of work assignments, leading to the development of capable professionals and managers (Northrup and Malin, 1985; Osterman, 1984).

However, there is a danger associated with this practice of internalized labor markets, particularly in large urban areas. The danger is that other firms will pirate or poach these valuable employees. As employees develop they become more valuable to the firm and trained employees can be pirated before the firm is able to secure returns on its investment. High technology firms are particularly vulnerable to poaching because many firms in this field prefer to purchase expertise in external labor markets rather than invest and train employees themselves (Rothwell, 1987; Scott and Storper, 1987). Most companies deplore pirating, but feel that they must engage in it in order to procure specialized skills in short supply (Northrup and Malin, 1985).

According to labor market theory, small firms in unstable new industries are drawn to metropolitan locations because of the nature of their linkages (which require them to be near customers, suppliers, and specialized business services) and in order to maximize their proximity to potential employees (Scott, 1988b; Morgan and Sayer, 1988). Rapid growth within firms and industries force these firms to obtain experienced managerial and research staff from the external labor market (Kanter, 1984). Conditions of rapid growth and limited firm size do not allow enough time to permit planning and development of an internal labor market. Thus, these firms rely on external labor markets, prefer experienced personnel, and concentrate together in large urban areas in order to reduce job search and recruitment costs (Stigler, 1961).

Large urban areas contain a larger labor market which makes it easier to recruit but difficult to retain personnel (Morgan and Sayer, 1988). Consequently, employee turnover rates tend to increase with city size (Pencavel, 1970; Pettman, 1975). Poaching--hiring experienced personnel away from competitors--is more prevalent in large urban areas (Northrup and Malin, 1985). Benefits include not only gaining experienced personnel but also acquiring insight into the operations and (possibly) trade secrets of competitors. In general, poaching favors new firms over old firms and large firms over small (Kanter, 1984; Northrup and Malin, 1985).

However, small innovative firms in urban agglomerations can also succeed in attracting from large firms top personnel who may feel they have become too entangled in paperwork and administration, and desire the opportunity to return to research and the leading edge developments taking place in the industry (Morgan and Sayer, 1988). Small firms can protect themselves from poaching through their personnel policies by providing such retention incentives as profit-sharing, stock grants or options, which fuel the hope of becoming high tech millionaires. Small firms can also lose valuable employees to entrepreneurship. Small firms are typically the training ground for entrepreneurs (Keeble and Weaver, 1986). Ownership and the rewards associated with being "the boss" stimulate entrepreneurship.

Labor turnover can also be reduced by increasing job rotation, staff training, and development (Rothwell, 1987). Providing a dual ladder career path for R&D employees, which gives the employee the option of advancing up either the managerial or the technical track with equal pay, rewards, and status, can aid large firms in retaining personnel (Kanter, 1984).

It was observed in Chapter 3 that professional and technical workers appear to have a locational preference for large metropolitan areas, as seen in their disproportionate concentration in these locations, relative to the labor force as a whole. This preference for large urban areas is due to quality of life considerations and job opportunities, as Chapter 4 has shown. As the size of the labor market increases it operates more efficiently (Scott and Angel, 1987). Workers are able to move from job to job with increasing ease as the local labor market increases in size. The concentration of high technology companies in Silicon Valley has increased the propensity of engineers and scientists in this area to change jobs (Northrup and Malin, 1985).

The findings in Chapter 4 reinforce the theoretical operations and characteristics of labor markets described above (Table 4.13). R&D facilities in large metropolitan areas reported a higher employee turnover rate and a preference for experienced personnel. These firms also reported less difficulty in attracting personnel who are members of dual career or dual worker couples.

Demographic and social realities presently taking place are expected to further encourage the attraction and concentration of professional workers to metropolitan areas. Women are entering the work force and professions in increasing numbers which, in turn, contributes to the rise of dual worker and dual career couples. The results from Chapter 3 demonstrate that dual career couples have an even greater tendency to concentrate in large urban areas than professional households in general. In order to attract and retain the best and brightest of professional workers (including those in dual career households) firms will have to become more flexible and responsive to their employees' needs (Schwartz, 1989). To do this, firms may have to reconsider location decisions and adapt career development policies including the use of transfers. If they adapt to employees' needs, firms will benefit through lower turnover, improved job performance, and productivity (Schwartz, 1989). Those firms that are more responsive to their employees will gain a competitive advantage in the attraction of top professionals. Thus, as dual worker and dual career couples become more the norm than the exception, it is expected that the professional labor force and the firms and their accompanying operations which depend on professionals will become increasingly concentrated in large metropolitan areas.

On the other hand, large firms in stable industries rely on internal labor markets, preferring new college graduates, and are thus capable of considering peripheral locations (Scott, 1988b). Stable and predictable growth allows for planning and promotion from within to take place (Kanter, 1984). Because of their large size, reputation, and secure position in the market place, these firms are thought to have little difficulty in attracting a suitable labor force. However, in reality, firms in remote locations do report some difficulty attracting qualified professionals (Clark, 1981; Glasmeier, 1986). This finding suggests that small cities and unattractive peripheral locations may have to recruit new college graduates because experienced personnel are unwilling to locate there. To overcome recruitment problems, firms in peripheral locations develop attractive long-term employment packages which demphasize the initial position and location. Employees are encouraged to think of these positions more as a stepping stone to other more attractive opportunities and locations within the firm (Northrup and Malin, 1985).

The utilization by firms of pools of skilled labor in peripheral areas has several advantage over agglomerations in metropolitan areas. Once recruited, key personnel in peripheral locations are more easily retained by the firm, because distance to other agglomerations and employers provides some protection against poaching (Morgan and Sayer, 1988). In this way, firms protect their investment in employee training, ensuring that trained workers remain with the firm. Peripheral locations offer other advantages as well, especially to technical branch plants. Employees in peripheral areas tend to be loyal, are more concerned with the quality of their work, and have relatively low turnover rates (Doeringer, 1984). Firms who locate in these areas will have the pick of the local labor force.

There are exceptions to the geographical concentration in and around large metropolitan areas. In the study, seven of the twenty-three R&D facilities surveyed were located in small cities, in part a result of attempting to avoid headquarter R&D sites in the sample. R&D facilities which had decentralized to small urban area locations reported both a preference for new college graduates and a lower employee turnover rate (Table 4.13). The decentralized R&D facilities were primarily in three industries: chemicals, aerospace, and industrial equipment. This suggests that the ability to disperse may vary by industry.

The aerospace industry in particular is known for its tendency to locate in decentralized areas. The aerospace industry is characterized by employment cycles which correspond to the cyclical nature of government contract work (Krumme and Hayter, 1975). By locating in small cities these firms can gain almost monopolistic control of the labor market, including skilled and professional personnel. Decentralized locations allow firms to lay off workers during lean times and the ability to rehire them when business returns (Doeringer, 1984).

The results in Chapter 4 suggest not only that the composition and operation of labor markets differ by city size, but that R&D facilities through location take advantage of these differences. In their recruiting practices, firms reinforce and perpetuate these differences, reproducing the types of labor they desire (Clark, 1981; Walker and Storper, 1981). Pockets of segmented labor are distributed and reproduced in space by the interplay of industries with similar labor demands and communities with institutions and cultures appropriate to the needs and wants of a certain segment of worker (Harvey, 1975; Walter, 1981; Piore, 1979).

Furthermore, the research findings suggest the presence of an implicit agreement among firms regarding the spatial division of labor between R&D facilities located in core and in peripheral areas. Dispersion of some R&D facilities has taken place because of implicit cooperation between R&D performing firms concerning labor. R&D facilities differ not only in location (core versus periphery) and the type of R&D conducted (unique research versus routine development), but also in the type of labor they prefer (experienced versus inexperienced) (Glasmeier, 1988). Cooperation prevents core and periphery facilities from competing for the same segment of the labor force and results in benefits to both in terms of reduced labor costs and a spatial division of labor.

## Location Theory: Criticisms and Reassessment

Over the past several decades significant economic, social, and demographic changes have take place and have resulted in a re-orientation of location theory. The decreasing influence of some location specific factors (such as raw materials and transport costs), the globalization of industry, competition, and markets, and the increasing separability of firm operations have increased the complexity of the location decision and created a greater number of potential sites to be considered for industrial location. Firms and facilities have a large choice of areas in which to operate, however, they are not free to locate just anywhere they please (Storper and Walker, 1984). Labor availability and quality as well as markets have remained differentiated over space and thus constrain and play an ever-increasingly role in determining firm location.

Marxian research has become focused on identifying labor as the only significant locational factor, but there are other locational factors which require consideration (Sayer, 1985; Morgan and Sayer, 1988). Access to markets (customers), suppliers, and skilled labor all contribute toward a concentration of industry (including R&D) to metropolitan areas. Marxian research has exaggerated the significance of labor-intensive production and cheap labor and has underestimated capital-intensive high skilled activities. This perspective has assumed that routine production and assembly operations will be labor-intensive and will therefore shift to cheap labor overseas locations, but fails to acknowledge the role of technology and capital-intensive production which is being established in core regions (Sayer, 1985). Marxian research has focused on branch plants, considering them to be virtually identical, ignoring highly specialized, small-batch custom production and unique production processes.

The role of competition and competitive strategies which give rise to different forms of industrial organization and location, is also ignored by the focus on labor. Firms compete not only based on price but also according to quality, reliability, and product capabilities (Sayer, 1985). Political realities and the role of the state in influencing the organization and location of firms have largely been ignored. The significance of the role of the state is illustrated in the different organizational structure and competitive strategies found in Japanese and American firms. Japanese firms are oriented toward long-run development and profits and are more willing to cooperate with other firms in order to facilitate the development of new products and technologies. On the other hand, American firms regard one another as competitors and are driven by short-run profits (Tatsuno, 1988).

Marxian research has also underestimated the importance of industrial agglomeration (Morgan and Sayer, 1988). The most important single element of agglomeration economies, which are derived from urban scale, relates to labor availability (Moseley, 1974). In this way, local labor markets are significant in determining the spatial concentration of firms (Scott, 1988a). Despite the past emphasis placed on labor it can no longer be regarded as the only major determinant of corporate location. Labor must be considered along with technology, competition, and markets. Technology, labor, competition, and markets are interdependent factors which affect the location of firms. Changes in technology or competition can effect the production processes used, and the level and composition labor. Research laboratories have been established at satelite locations, dispersed from corporate headquarters in order to gain access to labor and to relate R&D to local customers (Morgan and Sayer, 1988; Glasmeier, 1988). Thus, although still central to the locational decision, labor must be integrated into the context of markets, competition, and technology. Given the significance of the spatial variation of labor to the location of corporate activities, the next section will discuss the implications concerning regional economic development.

## Implications for R&D Location and Regional Development

Capitalist production is characterized as uneven, and this unevenness contains implications for regional development (Buswell, 1983; Keeble and Weaver, 1986). Production is uneven in that it is not found everywhere in equal amounts; rather, some locations are very successful in attracting industry, such as Silicon Valley, while other areas are less fortunate. The contribution of an industry to regional development depends not only on the level of the activity in the region but also on the character of that activity (Morgan and Sayer, 1988). It is not simply the presence of an industry that is of interest but whether it produces the formation of linkages and new firms, referred to as self-generating economic growth (Sweeney, 1987). The significance of R&D is its ability to generate new economic activity through new firm creation (Malecki, 1987). But not all regions are capable of attracting R&D (Buswell, 1983).

Regional fortunes are thus dependent on the activities of the firms which operate in them. New firms are not equally likely to arise in all industries or from all firm activities (Chesnais, 1986). The presence of R&D within a region does play a significant role in the formation of interindustry linkages and new firm formations. There is considerable evidence of the importance of technical change, scientific research, and innovation in generating new small companies in Britain (Keeble and Kelly, 1986). Many new firms are spin-offs based on ideas developed in other firm's R&D labs. Entrepreneurship contributes to an economy in terms of exports, employment, taxes, research and development, and innovations (Bollinger, Hope and Utterback, 1983). Products with high levels of R&D are more likely to form local linkages because of the unstandardized nature of the final product (Oakey, 1981). The development of local linkages means that jobs and revenue earned by local companies will remain in the region contributing to a multiplier effect. Case studies have identified that the development of linkages and new firms is influenced by the nature of the product and market, corporate policies toward personnel procurement and technology, and the technical nature of production itself (Glasmeier, 1988). Although both linkages and entrepreneurship contribute to economic growth, it is thought that the formation of new firms assists more in producing self-generating growth (Sweeney, 1987; Andersson, 1985).

Unfortunately, regions are still more dependent on firms for economic development then firms are dependent on regions (Morgan and Sayer, 1988). But, regions cannot depend on firms to solve their economic development problems. As a result, the emphasis in regional development policy has been toward the development of a region's indigenous growth potential by stimulating innovation and local entrepreneurship. This can best be accomplished when business, local government, and academia cooperate together to promote economic development (Smilor, Kozmetsky and Gibson, 1988). Planners and community leaders should work to encourage the expansion of a region's current industrial and commercial base by providing infrastructure and a receptive environment for new firms. This section will briefly review the findings of this study and explore the possibilities for regional economic development.

On the surface, the decentralization trend of R&D would appear to be positive, a means by which the benefits of economic growth are spread to different parts of the country, thus reducing the uneveness of economic development. However, the benefits and impacts of decentralized R&D are not as advantageous as was first thought. Glasmeier (1988) has shown that "technical branch plants", despite the presence of R&D, have not produced local linkages and spin-offs. Scott and Angel (1987) confirm this view. The semiconductor industry in Phoenix and Dallas has failed to generate new ventures and interindustry linkages that are characteristics of Silicon Valley.

Despite the ability of some areas to attract large firms and R&D operations, not all R&D produces new firms (Malecki, 1987). However, the case of Silicon Glen in Scotland (Haug, 1986) does raise some hope for American "technical branch plant" communities, such as Austin, Raleigh-Durham, Colorado Springs, and Orlando. Silicon Glen was established as a manufacturing site in the 1940s, R&D activities were added in the 1970s and spin-offs have occurred in the 1980s (Haug, 1986). Austin and Raleigh-Durham, in particular have the necessary conditions, large urban regions, air connections, and local universities, comparable to Silicon Glen. Only time will tell if they will produce self-generating growth. The

Scottish case does indicate that patience and focus on long-term economic development will be the agenda.

What does all this mean about the role of R&D in regional economic growth and development? The findings from this study indicate that despite this decentration trend, R&D facilities will remain concentrated in large urban areas. The dispersion of R&D facilities to major Sunbelt cities and suburban locations demonstrates that both quality of life and city size are important location determinants to professional workers and R&D.

City size is likely to remain a major variable in determining the economic structure of metropolitan places (Noyelle and Stanback, 1984). The findings of this study concur with Noyelle and Stanback (1984), who demonstrated conclusively that a city's industrial composition is influenced by city size. Furthermore, large cities are more likely to produce entrepreneurs than small, peripheral locations (Pennings, 1982).

The location decisions of R&D facilities and their workers are interdependent. The findings of this study indicate that the effect of employee preferences and labor market realities are beginning to outweigh the site-specific factors in determining firm location. Household migration decisions are increasingly influenced by demands for location specific amenities (i.e. quality of life) (Graves, 1983; Graves and Linneman, 1979). And, since the mobility, locational decisions, and choices of firms and households determine where economic development will take place, it would appear that R&D location and consequent economic development will be increasingly influenced by the quality of life of an area. How well a community or location serves as a residential site for professional labor is becoming increasingly significant. As a result, R&D facilities are having to consider such factors as quality of life, education system, lifestyle concerns, and alternative employment opportunities when choosing a location. Geographical location is becoming increasingly important as a recruitment device and community and lifestyle considerations are key to the successful recruitment, retention, and relocation of employees (Von Glinow, 1988; Myers, 1987). Also, quality of life is recognized as an important factor in economic development, especially for firms oriented toward R&D, high tech firms, or other enterprises employing a highly skilled labor force (Schmenner, 1982; Rogers and Larsen, 1984). Highly skilled residents are found to be more sensitive to negative trends in a community's quality of life (Myers, 1987).

What do these results suggest regarding regional economic development and public policy? First, the route and potential for successful economic development based on R&D is likely to vary considerably from place to place (because of the variability of the presence and quality of location specific amenities) and with city size. Second, the possibility for supporting entrepreneurship is through providing an environment that is conducive to new firm formation. Entrepreneurship is a social phenomenon and must be examined in that light. Sociocultural theory views the rate of new firm formation as strongly influenced by the existing socioeconomic mix and characteristics of the resident population of a locality, particularly the occupational structure of the resident population (Fothergill and Gudgin, 1982; Keeble and Weaver, 1986). Entrepreneurs are drawn from skilled workers, engineers, and research scientists (Keeble and Kelly, 1986). Since migration and location decisions of professional workers are greatly influenced by a region's locational attributes, the concentration of qualified researchers and entrepreneurs cannot be explained without reference to a region's residential environment and quality of life (Keeble and Kelly, 1986).

Planners can play a role in providing an entrepreneurial environment through quality of life. Planners have long been the managers of public well-being, promoting the welfare of the community and economic growth (Myers, 1988). Quality of life should be viewed as a strategic resource to be managed for its long-term contribution to economic development (Myers, 1987).

Although promoting economic growth and development is a main objective of planning, economic growth that is too rapid can destroy the favorable conditions--quality of life--which attracted firms to the region in the first place (Walker and Storper, 1981). The shift of R&D to suburban sites suggests the presence of certain diseconomies of scale associated with increasing city size. Agglomeration diseconomies such as increasing traffic congestion, pollution, and housing prices have reduced the attractiveness of some large city locations (such as Los Angeles, San Francisco, and New York) to professionals in favor of smaller cities or suburban sites (Saxenian, 1985; Northrup and Malin, 1985). However, it may not be city size which is causing R&D to leave but rather the negative effects of rapid growth. When growth is rapid, services become overloaded which results in a decline in the quality of life (Myers, 1988). For example Austin's boom ended prematurely because rapid growth quickly stretched the region's facilities to their limits; causing overcrowding at the airport, increasing housing prices, and traffic congestion. To avoid this decline, planners should focus on growth management, encouraging growth to take place while offsetting the negative effects of growth and protecting urban amenities. It is important for infrastructure to keep pace with the growth rate. This fact is often ignored, as most regions will gladly take what development they can get and hope to work out the infrastructure problems later (Fulton, 1986). Quality of life should be tied into overall planning policy, treated as part of the ongoing development processes which occur in a city, and thus should not be sacrificed in favor of growth. Planners need to make business aware that growth management and preserving the area's quality of life is in their best interest as well.

A high quality of life environment is attractive to professional and technical workers. Since the locational decisions of R&D facilities are influenced by the locational decisions of professional and technical workers, quality of life can thus help to attract R&D operations. Also the attraction of professional and technical workers can stimulate economic development because new businesses are typically started by engineers and research scientists (Keeble and Kelly, 1986). Thus, providing a favorable environment to professional and technical workers can create the potential for economic growth through entrepreneurship.

The findings of this study indicate that economic development based on R&D favors large urban areas. Large metropolitan centers have been identified as attractive locations for professional and technical labor and R&D facilities. Metropolitian areas with specific amenities and infrastructure are thought to have the greatest potential for fostering new firm formation (Britain and Gertler, 1986; Goddard et al., 1986). Social and demographic changes, such as the increasing number of women entering the labor force and the rise of dual career couples, are expected to further encourage the concentration of professionals in large cities, contributing to the agglomeration advantages of large urban areas. Public policy should focus on maintaining the benefits of agglomeration and avoiding diseconomies of scale. Issues of growth management and preservation of the quality of life of large cities should be the focus of public policy in order to preserve the concentration of R&D and the benefits associated with it.

The findings of this study paint a rather pessimistic outlook for smaller cities concerning economic development based on R&D. Medium size cities with a high quality of life and infrastructure, such as the presence of a university, along with small centers located in close proximity (i.e. commuting distance) to a major metropolitan area, have the potential to attract some R&D workers and facilities, especially technical branch plants. The presence of both types of labor--professional and nonprofessional--is important to the attraction of technical branch plants (Glasmeier, 1988). Although some researchers believe that an R&D based economic development strategy is only applicable to cities that possess a highly-regarded university specializing in science or engineering (Farley and Glickman, 1986), the findings of this study do not quite agree. The presence of a local university containing science and engineering programs does appear to be an attractive locational attribute to both R&D facilities and professionals regardless of its national ranking. Local universities and other research institutions play a fundamental role in providing skilled manpower, new technologies and scientific innovations, and entrepreneurs (Gould and Keeble, 1984; Keeble and Weaver, 1986). However, very few locations will have the necessary infrastructure to attract and support an R&D based economy (Farley and Glickman, 1986). Public policies in these centers should focus on the long-run development of human resources, education, and quality of life. A region's best chance for developing R&D is to improve its infrastructure and the socioeconomic environment, providing a location that is conducive and attractive to mobile professional and technical workers (Buswell, 1983).

## Conclusions

For all firms, the location and relocation of corporate functions will be more critical and increasingly constrained by labor market realities. As the competition for specialized skills increases, firms will have to be increasingly responsive to the needs and desires of their professional and technical work force in order to attract and retain the best people. Relocation may occur less frequently for fear of losing prized employees who are unwilling to move where their career or their spouses' career may be jeopardized. It is beneficial not only to employees but also to employers of professionals to locate in established urban agglomerations, where the job market and other urban amenities meet some threshold level. Labor market realities and constraints thus affect the location decisions of firms for the high-level functions and activities in which these employees work, and provide a further boost to the agglomeration advantages of large urban regions.

This chapter has discussed the findings of this study and how these results contribute to and correspond with location theory. The prospects and possibilities of economic development based on R&D have also been examined taking into consideration the research findings. The next chapter will provide a brief summary of the results, conclusions, and contributions of this study, and suggest future research directions.

# CHAPTER 6
# SUMMARY AND CONCLUSIONS

## Introduction

This study attempted to combine an investigation of the influence of professional and technical workers on the location of corporate R&D facilities with an analysis of the types of places and the urban attributes that are attractive to these workers and facilities. This final chapter provides a brief summary of the findings of this study, discusses the significance of the results, and finally, the implications regarding urban planning and possible future investigations.

## Summary of Results

The principal purpose of this research was to examine the degree to which the locational decisions of professional and technical workers determine the location of R&D facilities. This was accomplished in two distinct analyses. First, using U.S. Census of Population and Housing Public-Use Sample data, the migration patterns and personal characteristics of professional and technical workers, and dual career households were examined. Professional and technical workers were found to be the most mobile segment of the labor force, and in moving they tend to follow the same migratory pathways of the rest of the American population, from the Northeast and North Central regions of the country to the South and West. Professional and technical workers have a strong tendency to locate in large metropolitan areas. Large cities contain disproportionately more professional households than smaller cities.

This first portion of the study also investigated dual career couples--couples in which both spouses are employed full-time in professions. Dual career couples were found to differ significantly from other professional households. Dual career couples are younger, and more educated, and the wife earns a higher income than in other types of households. However, dual career couples are similar to other professional households in that they follow the same migration patterns and they tend to locate in the largest urban agglomerations.

The second analysis utilized data from surveys of both R&D facilities and their professional labor force. The findings suggest that both workers and firms have had to compromise somewhat from their "ideal" when choosing their present location. Firms have had to consider their professional labor force's demands for certain locational amenities and workers have had to consider the location of job opportunities. Quality of life and city size are important locational considerations to professional personnel in R&D facilities and to the organizations which employ them. Three urban attributes generally associated with threshold city size appear to be crucial in attracting R&D facilities--a university (containing graduate science and engineering programs), airport, and professional labor force. The significance of particular urban attributes varied by couple type and by age of employee. Dual career couples considered alternative job opportunities for both spouses, the presence of a university, restaurants and shopping, and cultural amenities as especially important in satisfying their locational priorities. As professional employees get older they place greater significance on the number of job opportunities available and the presence of an airport.

Finally, the characteristics and dynamics of the professional labor markets were found to vary by city size. Dual career and dual worker couples are more likely to be located in large cities, where there is a greater number and variety of job opportunities. Corporate recruitment varied by city size as well. R&D facilities in large urban centers preferred to hire experienced personnel, while facilities in smaller cities reported a preference for new college graduates. The contributions of this study will now be discussed.

## Significance of Study

Location theory considers labor to be a major factor in determining the location of industry. Most attention, however, has focused on production operations and on skilled and unskilled labor. As previously stated, little research has been conducted on the relationship between professional labor and higher-order firm functions, such as R&D.

The contribution of this study to location theory has already been discussed in Chapter 5; however, a few broader issues related to location theory and the development of places still remain. There are three unique features of this study: (1) it has provided a better understanding and a national glimpse of the geographical location and mobility patterns of professional and technical labor, (2) it has established that dual career couples significantly differ from other households in terms of location and mobility, and (3) it has aided in identifying the locational priorities of both R&D firms and their employees. Thus, this study has identified two significant points regarding corporate location: that R&D facilities which have decentralized may have been following their professional labor force, and that quality of life determines the locational preferences of professional and technical workers and R&D operations. The role of urban amenities and city size in satisfying the locational priorities of professional workers is the topic of the next section.

## Amenities and Urban Size

The shift of R&D to Sunbelt cities has illuminated the attraction of particular urban amenities to professional workers and thus to R&D facilities. This movement to Sunbelt areas is not limited solely to professionals but is part of a general population trend in the U.S. People are moving to Sunbelt locations in large part because of the attractiveness of the overall quality of life available in these locations. Desirable attributes generally related with these areas, and supported by the study's findings, include environmental quality, cost of living, recreational opportunities, and climate. A similar list of favorable attributes emerged from a case study of R&D workers in the Tampa-St. Petersburg area of Florida (Bradbury, 1988).

The results of this study also identified three other urban attributes which are generally associated with threshold city size. These attributes--a university (containing graduate science and engineering programs), airport, and professional labor force--are important to attracting R&D facilities, and suggests that only large cities will contain the infrastructure necessary for the attraction of R&D operations and professionals. However, some small cities are able to attract R&D operations that are tied to manufacturing--technical branch plants--which require both professional and nonprofessional labor. In support of this view of a threshold city size, the concentration of professional households listed in Table 3.6 suggests that the threshold city size corresponds to cities with populations of 500,000 or more. Thus R&D will remain a large city activity because of its need for a large professional labor force and its labor force's preferences for particular urban amenities which are generally associated with city size (as seen in Chapter 4). This implies that future economic growth and development, based on R&D, will remain concentrated in the largest urban areas of the country. This raises new questions concerning economic development opportunities and possible strategies for smaller cities.

## Future Investigations

Many of the weaknesses present in this study are a result of the difficulty associated with investigating the location decisions of R&D facilities. Choosing a location or relocating a R&D facility is such an infrequent occurance that it is difficult to actually examine the decision-making process. The degree of employee influence in determining the location of R&D facilities remains hidden. However, face-to-face interviews, such as those conducted in the Tampa-St. Petersburg case, indicate that as the recruitment of new personnel becomes more difficult firms pay greater attention to the attributes of their location and to employee opinions and preferences.

Although this study has indicated the importance of quality of life in attracting R&D activities and a highly educated labor force, much more investigation is necessary. The exact nature of the role of quality of life in determining economic development is not fully understood. Also, an appropriate measure of quality of life still remains to be found. Further research should focus on evaluating the significance of various urban amenities to attracting and satisfying people's locational priorities. The investigation of the Tampa-St. Petersburg area of Florida indicated that the desirability of some locational attributes, such as environmental quality, recreational opportunities, and climate, are offset by the presence of undesirable features of rising housing costs and traffic congestion, both of which are augmented by rapid growth and poor planning (Bradbury, 1988).

This raises the issue of the role of urban planning in encouraging economic growth, while at the same time preserving quality of life. Although these two tasks appear to conflict, they are really complementary (Myers, 1987). However, rapid growth such as that presently occurring in Sunbelt cities makes the task of balancing economic growth and quality of life much more difficult. Planners have generally failed to regard quality of life as an integrated concept; rather they have focused on individual issues, such as traffic congestion, housing developments, and pollution. Further research is necessary at the individual city level, in order to identify the significance of particular urban amenities, for quality of life should also encompass the unique features of a place. Thus investigations and quality of life measures should include the priorities local citizens place on different urban amenities (Myers, 1987). Despite the imprecision of the concept, the survey findings from this study indicate that most people do have a good idea of what quality of life is--the overall satisfaction with an area. There is a need to develop subjective and objective indicators of quality of life so that local trends can be monitored. Planners should concentrate their efforts on maintaining or improving the local quality of life, rather than making comparisions with other areas.

Finally, it is mainly Sunbelt cities that are experiencing rapid growth and the accompanying urban planning problems. This raises the possibility that the infrastructure and other advantages accumulated in the Northeast of the country could provide attractive locations to industries and economic development.

# APPENDIX A

## PROFESSIONAL AND TECHNICAL OCCUPATIONS

| Code | Occupation |
|---|---|
| 003 | Legislators |
| 004 | Chief Executives and General Administrators |
| 005 | Administrators and Officials |
| 006 | Administrators, Protective Services |
| 007 | Financial Managers |
| 008 | Personnel and Labor Relations Managers |
| 009 | Purchasing Managers |
| 013 | Managers, Marketing, Advertising and PR |
| 014 | Administration, Education and Related Fields |
| 015 | Managers, Medicine and Health |
| 019 | Managers and Administrators, NEC |
| 023 | Accountants and Auditors |
| 024 | Underwriters |
| 025 | Other Financial Officers |
| 026 | Management Analysts |
| 027 | Personnel, Training, and Labor Specialists |
| 028 | Purchasing Agents and Buyers |
| 029 | Buyers, Wholesale and Retail Trade |
| 033 | Purchasing Agents and Buyers NEC |
| 034 | Business and Promotion Agents |
| 036 | Inspectors and Comliance Officers |
| 037 | Management Related Occupations NEC |
| 043 | Architects |
| 044 | Aerospace Engineers |
| 045 | Metallurgical and Materials Engineers |
| 046 | Mining Engineers |
| 047 | Petroleum Engineers |
| 048 | Chemical Engineers |
| 049 | Neclear Engineers |
| 053 | Civil Engineers |
| 054 | Agricultural Engineers |
| 055 | Electrical and Electronic Engineers |
| 056 | Industrial Engineers |
| 057 | Mechanical Engineers |
| 058 | Marine and Naval Architects |
| 059 | Engineers NEC |
| 063 | Surveyors and Mapping Scientists |
| 064 | Computer Systems Analysts and Scientists |
| 065 | Operations and Systems Researchers and Analysts |

| | |
|---|---|
| 066 | Actuaries |
| 067 | Statisticians |
| 068 | Mathematical Scientists NEC |
| 069 | Physicists and Astronomers |
| 073 | Chemists |
| 074 | Atmospheric and Space Scientists |
| 075 | Geologists and Geodesists |
| 076 | Physical Scientists NEC |
| 077 | Agricultural and Food Scientists |
| 078 | Biological and Life Scientists |
| 079 | Forestry and Conservation Scientists |
| 083 | Medical Scientists |
| 084 | Physicians |
| 085 | Dentists |
| 086 | Veterinarians |
| 087 | Optometrists |
| 088 | Podiatrists |
| 089 | Health Diagnosing Practitioners NEC |
| 095 | Registered Nurses |
| 096 | Pharmacists |
| 097 | Dietitians |
| 098 | Inhalation Therapists |
| 099 | Occupational Therapists |
| 103 | Physical Therapists |
| 104 | Speech Therapists |
| 105 | Therapists NEC |
| 106 | Physicians' Assistants |
| 113 | Environmental and Marine Science Teachers |
| 114 | Biological Science Teachers |
| 115 | Chemistry Teachers |
| 116 | Physics Teachers |
| 117 | Natural Science Teachers |
| 118 | Psychology Teachers |
| 119 | Economics Teachers |
| 123 | History Teachers |
| 124 | Political Science Teachers |
| 125 | Sociology Teachers |
| 126 | Social Science Teachers |
| 127 | Engineering Teachers |
| 128 | Mathematical Science Teachers |
| 129 | Computer Science Teachers |
| 133 | Medical Science Teachers |
| 134 | Health Specialties Teachers |
| 135 | Business, Commerce, and Marketing Teachers |
| 136 | Agriculture and Forestry Teachers |
| 137 | Art, Drama, and Music Teachers |
| 138 | Physical Education Teachers |
| 139 | Education Teachers |
| 143 | English Teachers |
| 144 | Foreign Language Teachers |
| 145 | Law Teachers |

| | |
|---|---|
| 146 | Social Work Teachers |
| 147 | Theology Teachers |
| 148 | Trade and Industrial Teachers |
| 149 | Home Economics Teachers |
| 153 | Postsecondary Teachers NEC |
| 154 | Postsecondary Teachers, subject not specified |
| 155 | Prekindergarten and Kindergarden Teachers |
| 156 | Elementary School Teachers |
| 157 | Secondary School Teachers |
| 158 | Special Education Teachers |
| 159 | Teachers NEC |
| 163 | Counselors, Educational and Vocational |
| 164 | Librarians |
| 165 | Archivists and Curators |
| 166 | Economists |
| 167 | Psychologists |
| 168 | Sociologists |
| 169 | Social Scientists NEC |
| 173 | Urban Planners |
| 174 | Social Workers |
| 175 | Recreation Workers |
| 178 | Lawyers |
| 179 | Judges |
| 183 | Authors |
| 184 | Technical Writers |
| 185 | Designers |
| 186 | Musicians and Composers |
| 187 | Actors and Directors |
| 188 | Painters, Sculptors, Craft-Artists, and Artists |
| 189 | Photographers |
| 193 | Dancers |
| 194 | Artists, Performers, and Related Workers, NEC |
| 195 | Editors and Reporters |
| 197 | Public Relations Specialists |
| 198 | Announcers |
| 203 | Clinical Laboratory Technologists and Technicians |
| 204 | Dental hygienists |
| 205 | Health Record Technologists and Technicians |
| 206 | Radiologic Technicians |
| 207 | Licensed Practical Nurses |
| 208 | Health Technologists and Technicians NEC |
| 213 | Electrical and Electronic Technicians |
| 214 | Industrial Engineering Technicians |
| 215 | Mechanican Engineering Technicians |
| 216 | Engineering Technicians NEC |
| 217 | Drafting Occupations |
| 218 | Surveying and Mapping Technicians |
| 223 | Biological Technicians |
| 224 | Chemical Technicians |
| 225 | Science Technicians |
| 226 | Airplane Pilots and Navigators |

| | |
|---|---|
| 227 | Air Traffic Controllers |
| 228 | Broadcast Equipment Operators |
| 229 | Computer Programmers |

Source: Census of Population and Housing, 1980. Public-Use Microdata Sample A.

# APPENDIX B

## MSA'S INCLUDED IN STUDY DATA SET

Abilene, TX
Akron, OH
Albany, GA
Albany-Schenectady-Troy, NY
Albuquerque, NM
Alexandria, LA
Allentown-Bethleham-Easton, PA-NJ
Altoona, PA
Amarillo, TX
Anaheim-Santa Ana-Garden Grove, CA
Anderson, IN
Anderson, SC
Ann Arbor, MI
Anniston, AL
Appleton-Oshkosh, WI
Athens, GA
Atlanta, GA
Atlantic City, NJ
Augusta, GA-SC
Austin, TX
Bakersfield, CA
Baltimore, MD
Baton Rouge, LA
Battle Creek, MI
Bay City, MI
Beaumont-Port Arthur-Orange, TX
Bellingham, WA
Benton Harbor, MI
Billings, MT
Biloxi-Gulfport, MS
Binghamton, NY-PA
Birmingham, AL
Bloomington-Normal, IL
Boise City, ID
Boston, MA
Bradenton, FL
Bremerton, WA
Brownsville-Harlingen-San Benito, TX
Buffalo, NY
Canton, OH
Cedar Rapids, IO
Champaign-Urbana-Rantoul, IL

Charleston, SC
Charleston, WV
Charlotte, NC
Charlottesville, VA
Chattanooga, TN
Chicago, IL
Chico, CA
Cincinnati, OH
Cleveland, OH
Colorado Springs, CO
Columbia, MO
Columbia, SC
Columbus, GA
Columbus, OH
Corpus Cristi, TX
Dallas-Ft. Worth, TX
Danville, VA
Davenport-Moline, IL
Dayton, OH
Daytona Beach, FL
Decatur, IL
Denver-Boulder, CO
Des Moines, IA
Detroit, MI
Eau Claire, WI
El Paso, TX
Elkhart, IN
Erie, PA
Eugene-Springfield, OR
Evansville, IN-KY
Fall River, MA-RI
Fayetteville, NC
Fayetteville-Springdale, A
Flint, MI
Florence, SC
Fort Collins, CO
Fort Lauderdale-Hollywood, FL
Fort Myers-Cape Coral, FL
Fort Walton Beach, FL
Fort Wayne, IN
Fresno, CA
Gadsden, AL
Gainesville, FL
Galveston-Texas City, TX
Gary-Hammond-East Chicago, IN
Glen Falls, NY
Grand Rapids, MI
Greeley, CO
Green Bay, WI
Greensboro-Winston-Salem-High Point, NC
Greenville, Spartanburg, SC

Hagerstown, MD
Hamilton-Middletown, OH
Harrisburg, PA
Hartford, CT
Hickory, NC
Houston, TX
Huntington-Ashland, WV-KY-OH
Huntsville, AL
Indianapolis, IN
Jackson, MI
Jackson, MS
Jacksonville, FL
Jacksonville, NC
Janesville-Beloit, WI
Jersey City, NJ
Johnson City-Kingsport-Bristol, TN-VA
Johnston, PA
Joplin, MO
Kalamazoo-Portage, MI
Kankakee, IL
Kansas City, MO-KS
Kenosha, WI
Killeen-Temple, TX
Knoxville, TN
Kokomo, IN
Lafayette, LA
Lafayette-West Lafayette, IN
Lake Charles, LA
Lakeland-Winter Haven, FL
Lancaster, PA
Lansing-East Lansing, MI
Las Vegas, NV
Lawrence-Haverhill, MA-NH
Lawton, OK
Lexington-Fayette, KY
Lima, OH
Lincoln, NB
Little Rock, AR
Long Branch-Asbury Park, NJ
Longview-Marshall, TX
Lorain-Elyria, OH
Los Angeles-Long Beach, CA
Louisville, KY-IN
Lowell, MA-NH
Lubbock, TX
Lynchburg, VA
Macon, GA
Madison, WI
Manchester, NH
Mansfield, OH
McAllen-Pharr-Edinburg, TX

Medford, OR
Melbourne-Titusville-Cocoa, FL
Memphis, TN-AR-MS
Miami, FL
Milwaukee, WI
Mobile, AL
Modesto, CA
Monore, LA
Montgomery, AL
Muncie, IN
Muskegon-Norton Shores, MI
Nashville, TN
Nassau-Suffolk, NY
New Bedford, MA
New Britain, CT
New Brunswick, NJ
New Haven, CT
New Orleans, LA
New York, NY-NJ
Newark, NJ
Newark, OH
Newburgh-Middletown, NY
Newport News-Hampton, VA
Norfolk-Virginia Beach-Portsmouth, VA-NC
Norwalk, CT
Ocala, FL
Odessa, TX
Oklahoma City, OK
Olympia, WA
Omaha, NB-IA
Orlando, FL
Oxnard-Ventura, CA
Pascagoula-Moss Point, MS
Paterson-Clifton, NJ
Pensacola, FL
Peoria, IL
Petersburg-Colonial Heights, VA
Philadelphia, PA
Phoenix, AZ
Pittsburgh, PA
Portland, ME
Portland, OR-WA
Portsmouth-Dover-Rochester, NH-ME
Providence-Warwick-Pawtucket, RI-MA
Provo-Orem, UT
Pueblo, CO
Racine, WI
Raleigh-Durham, NC
Reading, PA
Redding, CA
Reno, NV

Richland-Kennewick-Pasco, WA
Richmond, VA
Riverside-San Bernardino, CA
Roanoke, VA
Rochester, NY
Rockford, IL
Rock Hill, SC
Sacramento, CA
Saginaw, MI
St. Joseph, MO
St. Louis, MO-IL
Salem, OR
Salinas-Seaside-Monterey, CA
Salisbury-Concord, NC
Salt Lake City-Ogden, UT
San Antonio, TX
San Diego, CA
San Francisco-Oakland, CA
San Jose, CA
Santa Barbara, CA
Santa Rosa, CA
Sarasota, FL
Savannah, GA
Seattle-Everett, WA
Sharon, PA
Sheboygan, WI
Shreveport, LA
Sioux City, IA-NB
Sioux Falls, SD
South Bend, IN
Spokane, WA
Springfield, IL
Springfield, MO
Springfield, OH
Springfield-Chicoppe-Holyoke, MA-CT
Stamford, CT
State College, PA
Stockton, CA
Syracuse, NY
Tacoma, WA
Tallahassee, FL
Tampa-St. Petersburg, FL
Terre Haute, IN
Toledo, OH-MI
Topeka, KS
Trenton, NJ
Tucson, AZ
Tulsa, OK
Tuscaloosa, AL
Tyler, TX
Utica-Rome, NY

Vallejo-Fairfield-Napa, CA
Vineland-Bridgeton, NJ
Visalia, CA
Waco, TX
Washington, DC-MD-VA
Waterbury, CT
Waterloo-Cedar Falls, IA
Wausau, WI
West Palm Beach-Boca Raton, FL
Wichita, KS
Wichita Falls, TX
Williamsport, PA
Wilmington, DE-NJ-MD
Wilmington, NC
Worcester, MA
Yakima, WA
York, PA
Youngstown-Warren, OH

Source: Census of Population and Housing, 1980. Public-Use Microdata Sample A.

## APPENDIX C

## UNIVERSITY OF FLORIDA DEPARTMENT OF GEOGRAPHY
## CORPORATE FACILITY QUESTIONNAIRE

1. How long has your firm conducted R&D in the Austin area?

______________________________

2. Do you have any problems atttracting skilled professional workers to this location? Yes No (please circle)
If yes, please elaborate. ______________________________

______________________________

3. Is the turnover rate of your professional workers
___ higher than you would like, or
___ about typical for this type of facility?

4. What is your firm's annual average turnover rate (%) for R&D and technical employees? ______________

5. What is the recruiting areas for this facility?
___ the Southwest, ___ the Southeast, ___ the Northeast,
___ California, ___ Midwest, or ___ all of the U.S.

6. Does your firm have a recruiting preference for:
___ experienced personnel, ___ new college graduates,
or ___ no preference?

7. Do you consider the Austin area "high-tech"? Yes No

8. What "high-tech" characteristics does the Austin area lack?
___ venture capital
___ a major research university
___ previous successful entrepreneurs
___ a large number of high-tech firms
___ a large skilled professional labor force
___ other (please identify) ______________

9. Have you found that workers with employed spouses are more difficult a) to attract? Yes No
b) to transfer to other firm locations? Yes No

10. With regard to recruiting or transferring employees does the issue of an employed spouse arise ___ frequently, ___ sometimes, or ___ almost never?

11. Does your firm assist the spouses of recruited employees in their job search? Yes No If yes, please describe. ____________________________________________

______________________________________________________

12. Has there been ___ an increase, ___ a decrease, or ___ no change in your firm's use of job transfers?

13. a) Would your firm prefer to be located in a ___ larger, ___ smaller, or ___ about the same size place as the Austin area?

b) If your firm would prefer to be in a larger or smaller place, why? ____________________________________________

______________________________________________________

14. a) Would you classify the local airport as a "major airport" (i.e. does it offer frequent flights to many destinations)? Yes No

b) Do you have convenient access to a major airport? Yes No

15. a) Does your company have any contact with the local university(ies)? Yes No

b) If yes, with which ones do you have major ties? ______

______________________________________________________

c) Why? ___ for employee recruitment, ___ research information, or ___ other (please describe) __________

______________________________________________________

16. Are excellent private schools available in the area? Yes No

17. Are the level of municipal services (e.g. streets and highways, garbage collection and emergence services) adequate in the Austin area? Yes No

18. In relation to the services provided, are taxes ___ too high, ___ too low, or ___ about right?

19. If your firm were to move to an "ideal" location (or, if you prefer, your facility's current location), for the following list of factors please identify their importance to your firm and to your employees, with the value 1 corresponding to Unimportant (U) and the value 5 to Very Important (VI).

| | Ideal Location | |
|---|---|---|
| | Importance to Firm | Importance to employees |
| | U VI | U VI |
| Accessibility to firm headquarters | 1 2 3 4 5 | 1 2 3 4 5 |
| Availability of professional workers | 1 2 3 4 5 | 1 2 3 4 5 |
| Proximity to other similar firms | 1 2 3 4 5 | 1 2 3 4 5 |
| Proximity to a university | 1 2 3 4 5 | 1 2 3 4 5 |
| Proximity to other research facilities | 1 2 3 4 5 | 1 2 3 4 5 |
| Proximity to a major airport | 1 2 3 4 5 | 1 2 3 4 5 |
| Accessibility to market or customers | 1 2 3 4 5 | 1 2 3 4 5 |
| Accessibility to major suppliers | 1 2 3 4 5 | 1 2 3 4 5 |
| Community attitude toward business | 1 2 3 4 5 | 1 2 3 4 5 |
| Economic growth potential | 1 2 3 4 5 | 1 2 3 4 5 |
| Overall business climate | 1 2 3 4 5 | 1 2 3 4 5 |
| Entrepreneurial venture opportunities | 1 2 3 4 5 | 1 2 3 4 5 |
| Number of alternative employers | 1 2 3 4 5 | 1 2 3 4 5 |
| -- for employees | 1 2 3 4 5 | 1 2 3 4 5 |
| -- for employees' spouses | 1 2 3 4 5 | 1 2 3 4 5 |
| Cost of living -- for housing | 1 2 3 4 5 | 1 2 3 4 5 |
| -- for other | 1 2 3 4 5 | 1 2 3 4 5 |
| Quality of public education | 1 2 3 4 5 | 1 2 3 4 5 |
| Quality of private schools | 1 2 3 4 5 | 1 2 3 4 5 |
| Recreational opportunities offered | 1 2 3 4 5 | 1 2 3 4 5 |
| Presence of cultural amenties | 1 2 3 4 5 | 1 2 3 4 5 |
| Restaurants and shopping | 1 2 3 4 5 | 1 2 3 4 5 |
| Climate | 1 2 3 4 5 | 1 2 3 4 5 |
| Environmental quality | 1 2 3 4 5 | 1 2 3 4 5 |
| Traffic Congestion | 1 2 3 4 5 | 1 2 3 4 5 |
| Nearness to family | 1 2 3 4 5 | 1 2 3 4 5 |

20. We are interested in the attributes of the area where your facility is currently located. How would you evaluate each of the factors listed below in terms of meeting the needs of your firm? Please use the value 1 to correspond to Deficient; (2 = slightly deficient; 3 = adequate; 4 = very good) and the value 5 Excellent.

| | Deficient | | | | Excellent |
|---|---|---|---|---|---|
| Accessibility to firm headquarters | 1 | 2 | 3 | 4 | 5 |
| Availability of professional workers | 1 | 2 | 3 | 4 | 5 |
| Proximity to other similar firms | 1 | 2 | 3 | 4 | 5 |
| Proximity to a university | 1 | 2 | 3 | 4 | 5 |
| Proximity to other research facilities | 1 | 2 | 3 | 4 | 5 |
| Proximity to a major airport | 1 | 2 | 3 | 4 | 5 |
| Accessibility to market or customers | 1 | 2 | 3 | 4 | 5 |
| Accessibility to major suppliers | 1 | 2 | 3 | 4 | 5 |
| Community attitude toward business | 1 | 2 | 3 | 4 | 5 |
| Economic growth potential | 1 | 2 | 3 | 4 | 5 |
| Overall business climate | 1 | 2 | 3 | 4 | 5 |
| Entrepreneurial venture opportunities | 1 | 2 | 3 | 4 | 5 |
| Number of alternative employers | 1 | 2 | 3 | 4 | 5 |
| -- for employees | 1 | 2 | 3 | 4 | 5 |
| -- for employees' spouses | 1 | 2 | 3 | 4 | 5 |
| Cost of living -- for housing | 1 | 2 | 3 | 4 | 5 |
| -- for other | 1 | 2 | 3 | 4 | 5 |
| Quality of public education | 1 | 2 | 3 | 4 | 5 |
| Quality of private schools | 1 | 2 | 3 | 4 | 5 |
| Recreational opportunities offered | 1 | 2 | 3 | 4 | 5 |
| Presence of cultural amenties | 1 | 2 | 3 | 4 | 5 |
| Restaurants and shopping | 1 | 2 | 3 | 4 | 5 |
| Climate | 1 | 2 | 3 | 4 | 5 |
| Environmental quality | 1 | 2 | 3 | 4 | 5 |
| Traffic Congestion | 1 | 2 | 3 | 4 | 5 |
| Nearness to family | 1 | 2 | 3 | 4 | 5 |

21. Are there any factors that are important but are not on the list? If so, please give them. ____________________

______________________________________________________________

______________________________________________________________

22. Are there some locations that would be "better" for your firm? Yes No If yes, please list them

-- for recruiting and retaining professional and technical workers ________________________________

______________________________________________________________

-- for interaction with rest of the firm ______________

______________________________________________________________

-- for access to new technology ________________________

______________________________________________________________

Thank you for your time and consideration.

Please return to: Professor Edward J. Malecki
Department of Geography
University of Florida
Gainesville, Fl 32611

Any questions, call (904) 392-0494.

UNIVERSITY OF FLORIDA DEPARTMENT OF GEOGRAPHY
PROFESSIONAL AND TECHNICAL WORKERS STUDY

BACKGROUND

1. When did you move to the Austin area? ________________
2. Where did you move from? ______________________________
3. Where did you last attend college or university?

   ______________________________________________________

4. Is your age ___ 34 and under; ___ 35 to 45; ___ 46 to 55; ___ 56 and over?
5. a) Male Female (please circle)

   b) Are you married? Yes No (please circle)

   ** If not married, please go to Question #14 **

6. Does your spouse work? Full-time Part-time No

   If employed, what is your spouse's occupation?

   ______________________________________________________

JOB SEARCH

7. Whose job encouraged the move to the Austin area?

   ___ yours, ___ your spouse's, or ___ both?

8. Whose job has prompted past moves?

   ___ yours, ___ your spouse's, or ___ both?

9. How many job-related moves have you as a couple made?

   ______________________________________________________

10. If both you and your spouse are employed full-time: Would you describe trying to find two jobs in the same area as ___ easy, ___ somewhat difficult, or ___ very difficult?
11. Have either of you had to compromise career goals in moving to your present location? Yes No If yes, please describe. ______________________________

    ______________________________________________________

12. Did your present employer offer to assist your spouse in her/his job search? Yes No If yes, please describe.

____________________________________________

13. How would you describe your experience in relocating?
___ Did one spouse locate a job first and the other look in the same area upon arrival?
___ Did each spouse look for work independently and then accept the best joint option?
___ Did you together choose to locate in one area and concentrate your job search there?
___ Do you alternate as to whose career takes precedence?
___ Other methods (please describe) ________________

14. When you moved to the Austin area what other places did you seriously consider for employment? ____________

____________________________________________

15. Was this move:
___ a transfer with the same employer;
___ a job with a new employer,
___ to attend college or university, or
___ other (please describe) ____________________

16. Have you switched employers since you moved here? Yes No

17. Does the Austin area in your opinion offer a satisfactory range of attractive job alternatives -- for you? Yes No
-- for your spouse? Yes No

18. a) Have you ever considered strating an independent business? Yes No
b) Have you ever done so? Yes No

19. a) Would you prefer to live in a ___ larger, ___ smaller, or ___ about the same size place as the Austin area?
b) If you would prefer to live in a larger or smaller place, why? ____________________________

____________________________________________

20. In seeking a new job, which do you consider is more important in a place:

___ the job opportunities available, or

___ the social-cultural 'ambiance' of a place?

21. a) If your employer transferred you to another city, would you:___ move to keep your job, or

___ stay in the area and look for another job?

22. a) Do you presently live near your (or your spouse's) family? Yes No

b) If no, would you prefer to be closer? Yes No

23. Would you rate the Austin area as "high-tech"? Yes No

24. What does the Austin area lack as far as being high-tech?

___ venture capital
___ a major research university
___ previous successful entrepreneurs
___ a large number of high-tech firms
___ a large skilled professional labor force
___ other (please identify) ______________________

25. a) Would you classify the local airport as a "major airport" (i.e. does it offer frequent flights to many destinations)? Yes No

26. Do you have convenient access to a major airport? Yes No

27. Do you have children? Yes No

28. If yes, how many in each age group? ___ under 6; ___ 6 to 18; ___ 18 and over?

29. If they are 6 to 18, do they attend ___ public or ___ private school?

30. Are excellent private schools available in the area? Yes No

## CHOOSING A LOCATION

31. If you were to move to another city, what would you be looking for in your new location? For each of the factors listed below please rate its importance, using the value of 1 for Unimportant (U) and the value 5 for Very Important (VI).

| | Unimportant | | | | Very Important |
|---|---|---|---|---|---|
| Number of alternative employers | | | | | |
| -- for you | 1 | 2 | 3 | 4 | 5 |
| -- for spouse | 1 | 2 | 3 | 4 | 5 |
| Nearby university -- for academic programs | 1 | 2 | 3 | 4 | 5 |
| -- for culture & recreation facilities | 1 | 2 | 3 | 4 | 5 |
| Proximity to a major airport | 1 | 2 | 3 | 4 | 5 |
| Community attitudes | 1 | 2 | 3 | 4 | 5 |
| Economic growth potential | 1 | 2 | 3 | 4 | 5 |
| Entrepreneurial venture opportunities | 1 | 2 | 3 | 4 | 5 |
| Cost of living -- for housing | 1 | 2 | 3 | 4 | 5 |
| -- for other | 1 | 2 | 3 | 4 | 5 |
| Quality of public education | 1 | 2 | 3 | 4 | 5 |
| Quality of private schools | 1 | 2 | 3 | 4 | 5 |
| Recreational opportunities offered | 1 | 2 | 3 | 4 | 5 |
| Presence of cultural amenties | 1 | 2 | 3 | 4 | 5 |
| Restaurants and shopping | 1 | 2 | 3 | 4 | 5 |
| Climate | 1 | 2 | 3 | 4 | 5 |
| Crime rate | 1 | 2 | 3 | 4 | 5 |
| Environmental quality | 1 | 2 | 3 | 4 | 5 |
| Traffic Congestion | 1 | 2 | 3 | 4 | 5 |
| Availability of venture capital | 1 | 2 | 3 | 4 | 5 |
| Nearness to family | 1 | 2 | 3 | 4 | 5 |

32. Are there any factors that are important but are not on the list? If so, please give them. ____________________

____________________________________________________________

____________________________________________________________

RATING YOUR LOCATION

33. How do you rate the quality of life factors of the area where you currently live? Please rate each of the factors listed below in terms of how they meet your personal requirements. Consider the value 1 ro correspond to Inferior (2 = Slightly Inferior; 3 = Adequate; 4 = Very Good) and 5 to be Excellent.

| | Inferior | | | | Excellent |
|---|---|---|---|---|---|
| Number of alternative employers | | | | | |
| -- for you | 1 | 2 | 3 | 4 | 5 |
| -- for spouse | 1 | 2 | 3 | 4 | 5 |
| Nearby university -- for academic programs | 1 | 2 | 3 | 4 | 5 |
| -- for culture & recreation facilities | 1 | 2 | 3 | 4 | 5 |
| Proximity to a major airport | 1 | 2 | 3 | 4 | 5 |
| Community attitudes | 1 | 2 | 3 | 4 | 5 |
| Economic growth potential | 1 | 2 | 3 | 4 | 5 |
| Entrepreneurial venture opportunities | 1 | 2 | 3 | 4 | 5 |
| Cost of living -- for housing | 1 | 2 | 3 | 4 | 5 |
| -- for other | 1 | 2 | 3 | 4 | 5 |
| Quality of public education | 1 | 2 | 3 | 4 | 5 |
| Quality of private schools | 1 | 2 | 3 | 4 | 5 |
| Recreational opportunities offered | 1 | 2 | 3 | 4 | 5 |
| Presence of cultural amenties | 1 | 2 | 3 | 4 | 5 |
| Restaurants and shopping | 1 | 2 | 3 | 4 | 5 |
| Climate | 1 | 2 | 3 | 4 | 5 |
| Crime rate | 1 | 2 | 3 | 4 | 5 |
| Environmental quality | 1 | 2 | 3 | 4 | 5 |
| Traffic Congestion | 1 | 2 | 3 | 4 | 5 |
| Availability of venture capital | 1 | 2 | 3 | 4 | 5 |
| Nearness to family | 1 | 2 | 3 | 4 | 5 |

34. If you were to move in the near future, what are some potential places? ________________________________

________________________________________________

Why? ____________________________________________

________________________________________________

35. Are the level of municipal services (e.g. streets and highways, garbage collection and emergence services) adequate in the Austin area? Yes No

36. In relation to the services provided, are taxes ___ too high, ___ too low, or ___ about right?

37. Does the Austin area offer a satisfactory range of restaurants and shops? Yes No If no, where do you shop? ________________________________

Thank you for your time and consideration.

Please return to:
Professor Edward J. Malecki
Department of Geography
University of Florida
Gainesville, Fl 32611

Any questions, call (904) 392-0494.

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I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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